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VOL. CXLI., No. 2853.] TUESDAY, JANUARY 15, 1918. [70TH YEAR.

EDITORIAL NOTES.

Pioneer Steps in Gaseous Fuel Supply.

THE coming session of Parliament should be an important one in the history of the gas industry, if the Parliamentary Authorities are properly instructed, and are sufficiently appreciative. A point has been reached in the development of gas supply at which the industry may ask, with considerable assurance, for greater freedom in serving the nation by the provision of a cheaper gaseous fuel of good combustible quality, which will give a high flame temperature, despite a lower calorific standard than that now arbitrarily fixed, and for liberty also in developing its secondary products in a manner that will result in economy, and so inure to the advantage of both the community and the industries of the country. While the industry generally will not be before Parliament this year, the primary steps are being taken to what must be its objective if the industry is not to be permanently stunted in its growth, and the community robbed of the benefits that fresh knowledge has shown are within reach. There must be a start; and the South Suburban and the South Shields Companies are proposing to make it. It will therefore be for the Parliamentary Authorities to look into the matter, not from the point of view of custom or precedent, but in the light of the fresh knowledge and experience that have accrued of late years, especially during the war years.

When we come to review the Bills of the two Companies mentioned, it will be seen that they are in effect asking for authorization to provide alternative supplies of gas, which can be used for any purpose—gas which can be described as "non-illuminating" instead of "power" gas, which can be employed for incandescent burners and for all purposes to which a heating and power gas is applicable; and this gas it is proposed shall be free from all restrictions (other than the conditions applying to power gas) as to quality and pressure, though not to be used for the purpose of producing a luminous flame, even if this were possible. If we interpret the intention correctly, it merely means that any person or premises on the line of a main supplying non-illuminating gas may take such a supply, or alternatively a supply of the gas which is subject to the conditions of calorific power, pressure, &c. The proposal, it appears to us, confers freedom and an option upon the consumers who may, when the second supply is available, be fortunate enough to be on the line of mains. In the South Suburban Bill, it is provided that, notwithstanding anything contained in the clauses referring to power gas in the Company's Act of 1912, they "may supply power gas for utilization *for* "*any purpose*; and any person to whom power gas is sup- "plied may use the same for any such purpose," provided that power gas shall not be supplied or used "for purposes "of illumination otherwise than by means of incandescent "burners." The South Shields Gas Company also ask for exemption from all enactments as to illuminating power, calorific value, pressure, and purity "in respect of gas sup- "plied by them for utilization *for any purpose* other than "direct lighting." To this gas the term "non-illuminating" is applied. The Company also ask that they "may charge "in respect of non-illuminating gas supplied to the occupier "*of any premises* within the limits of supply of the Company "such sums as may be agreed between the Company and "such occupier." There is not the slightest reason why if the gas is useful for heating in factories and workshops, it should not also be useful for other purposes. We have no reason to suppose that these clauses will always remain (so to speak) a dead letter, but that they will in time become actively operative. And the sooner the better, because, as the Parliamentary Authorities ought readily to see, there are in these cases fine opportunities for making experiments under diverse actual working conditions in the supply of an untrammelled gaseous fuel—opportunities that should represent a valuable concomitant to the experimental investigation of the Board of Fuel Research.

Among the calorific clauses this year, there are proposals for standards of 450 and 475 B.Th.U.; and Parliament will thereby be asked to consider the experience promoted and provided by the removal from town gas of those hydrocarbons that are essential for war, dye, and liquid fuel purposes, as well as the question of the economical use of coal and the reduction of the consumption of imported oil in gas production by making and distributing a mixed coal and blue water gas of good combustible composition. They will also have their attention directed to the greater importance of flame temperature in the consumers' dwellings or other premises than calorific power as tested by a calorimeter in the laboratory. The Sheffield Gas Company are seeking to remove the absurd restriction as to lighting imposed last year upon their use of coke-oven gas, which delimits its value, and would compel its distribution through a separate set of mains. Other gas undertakings, too, are desirous of obtaining power (similar to that granted in recent sessions) for the purchase of crude or partially purified gas. All this movement points to the fresh developments that knowledge and technical endeavour are introducing into the operations of the industry—developments that are, in fact, opportune in view of the demands for a cheaper gaseous fuel supply, and of the aspirations for producing greater internal economy in the daily life and activities of the nation.

There is one thing which we regret about some of the Bills deposited this year; and it is the inclusion of the one-third purchasing power for secondary products. The protest of the gas industry against this injustice—an injustice imposed in defiance of the conclusions of the Joint Committee as to free trade in this regard, and in opposition to common sense—ought to be continued by its omission from Bills, even though it is at a later stage mistakenly insisted upon by the Private Bill Authorities.

Spontaneous Heating and Ignition of Coal.

THE inferior quality of unpicked gas coal that is still being delivered, with its large percentage content of pyrites and dust, has been giving considerable trouble through the spontaneous ignition of stacks, which, owing to the conditions of labour and transit, have had to be largely increased, both in girth and depth, during the summer months, in order to provide for the winter when deliveries have to be reduced owing to prevailing circumstances, while the output of gas has to be augmented. The importance of taking every possible precaution to prevent over-heating, and if, unfortunately, there be over-heating, to deal with it promptly, has been in these times severely impressed upon some gas engineers. The causes of coal heating and spontaneous ignition are well known to most gas engineers who use coals more particularly susceptible to rapid oxidation if the conditions are favourable. Special interest, however, will be found in a report which we publish in to-day's issue by Prof. George Knox, on the "Spontaneous Ignition of Coal;" and the suggestions that he offers will, if followed, do much to avert trouble, and others, upon incipient trouble being detected, will minimize the effect. Prof. Knox has had exceptional opportunities for studying the question in its various phases among the large heaps of small coal that

have accumulated in the South Wales and Monmouthshire coal-fields. The physical condition of the coal, the size, the method of stacking, and depth are all factors bearing upon the question of heating and ignition; and these are discussed and advice given. We will not epitomize the points, but will leave the report and its many useful hints to speak for themselves.

There are two or three matters upon which comment may be made. Prof. Knox suggests the use of ventilating-pipes inserted at intervals in the mass of coal, to allow of the heat being radiated as it is generated by oxidation. One expert within our knowledge has been inclined to condemn the use of ventilating-pipes, on the ground that, acting as shafts, they promote the circulation of air in the mass, and thus, with coals of a highly oxygen absorptive nature, tend to induce more rapid oxidation, and therefore heating. This may possibly have been hypothesis rather than the result of experimental work such as, we believe, is the basis of Prof. Knox's recommendation. It will also be observed that a further piece of advice is, if there is danger of oxidation suddenly increasing the temperature to the ignition point, to sink a number of small pits in the region of greatest temperature, and keep these flooded. The result will be that the water will gradually filter through the mass, and absorb a large percentage of the heat. This might be a somewhat troublesome procedure in the case of gas-works with, in these times, little labour available. But we know of a works where a kindred, but rather more expeditious, method has been successfully tried. A tube 1½ in. internal diameter pointed at the bottom end, and with a number of ¼-in. holes drilled at the lower part, is driven into the coal where heat-zones are indicated. Water is connected to the tube; and it is found that it runs pretty freely through the coal. By gradually driving the tube to the required depths, water can be introduced into the very heart of the heated coal, and have the desired effect. It should be mentioned that at the top of the tube a T-piece is fitted to which the hose is connected; and above the T-piece is a strong iron cap so that the tube can be driven through the coal with a heavy wooden mallet. A point that is often overlooked is that coal should not be stored behind any wooden barricade or other wooden structure; seeing that the ignition point of timber is much lower than that of coal. There are gas engineers who have experienced the additional danger introduced by wooden structures. However, these are only two or three points suggested by the report, the greatest value of which is found in the rules laid down for preventing trouble, or, if trouble does menace, the most effective methods of dealing with it. We shall be pleased at any time to hear from Prof. Knox regarding any further investigations that he may make in this direction.

Taking Stock of the Gas Industry's Position.

IN the concluding passages of the long paper which Mr. W. Newton Booth, B.Sc. (Lond.), read before the members of the London and Southern District Junior Gas Association on Friday last, he stated that he looked forward with great confidence to the future of the gas industry. But the preceding part of the paper is in effect one long qualification of this confidence. The communication is a thoughtful examination of what has to be, and what must be, done to ensure this confidence. We believe, knowing the men of the industry, that all that is necessary will be accomplished; but the curve of confidence will ascend more markedly as we see active work proceeding to realize the results that are essential to the industry's future. Taken point by point, there is nothing very new in the paper; but the bringing together of the points into an aggregate is new, and so is the personal comment. The technical and commercial men of the industry would not be worth their salt, let alone their positions and salaries, if they did not proceed to work on the lessons which have been reaped from the war period. In the "JOURNAL" we have, on all available opportunities, seriously urged the pressing need, notwithstanding the harassing conditions of the present, of making preparations for the conditions that it must be recognized will exist after the war comes to an end; and illustration has been taken from the Central Powers to show that long systematic preparation gave them their opening success in the war, and that their power of resistance so long against the united strength of the Allies is entirely due to the same cause. There is a forcible lesson there. But inertia may ride superior to it, to the detriment and ultimate regret of those who may be guilty of it. A constant incentive to action is obtained by keeping well in mind the fact that the gas industry is surrounded by competitors for business in light, heat, power, and fertilizers; and, after the war, these will be putting out all their strength to win further custom. Following the war, too, we may see new carbonizing systems springing up, the products from which coming upon the market will to that extent affect the economic position of the older established carbonizing industries. Mr. Newton Booth urges that the work of the gas industry should be directed to giving it, in every branch of its operations, a balance of advantage through economy over its competitors. In considering who are the competitors and their relative importance, as well as in deciding upon the course of preparation and policy, we must not take a too circumscribed point of view. Electricity is only one competitor. Coal is another. It will become cheaper, and the coalowners will keep a very sharp eye upon the work that is being done by the gas industry, through gaseous and coke fuels, to lessen the importance of their profitable domestic and factory coal markets; and their procedure will be ordered accordingly. It is owing to its diversity of business that a large outlook must be adopted by the gas industry—and now. Mr. Newton Booth examines the requirements for the provision of light, heat, and power by the gas industry, and makes inquiry into the position and prospects of the competitors in the same field. We shall stand well if only our work of preparation puts at the disposal of those who require light, heat, and power, a cheap gas of (upon combustion) high calorific intensity or flame temperature, with the comburivity, density, and pressure maintained on standard lines. The details of the interesting paper are too many for comment. But, taken together, they emphasize the truth that the factors attacking the stability of the gas industry were never greater than now. Hence the factors necessary to the protection of its stability were never in greater need of development and reinforcement.

Home-Made Benzol Recovery Plants.

EXISTING oil-washing plants for benzol recovery have to be worked to their maximum extent in order to maintain the volume of substances required by the High Explosives Department of the Ministry of Munitions, which is not a decreasing quantity; and now, owing to the position of the supply of materials and labour, with contractors, too, pushed up into a tight corner with Government work, it is hopeless, except under rare circumstances, and then only by the aid of a batch of priority certificates and what not, to obtain the erection of any new plant for this purpose. There is room, however, for much more being done than there has been up to the present in showing patriotism, enterprise, and engineering ability by constructing home-made oil-washing plants from spare parts. A difficulty, however, is that, such plants being constructed of spares and a variety of discarded apparatus that has been employed on altogether different service, it is impossible to offer a standard specification as to how to construct such a plant. But surely something better might be done than has been for general guidance, so as to save some of the time and trouble expended by willing engineers of the smaller works in proceeding to attain a position comparatively free from difficulty and yielding a good efficiency with the plant at command. Among published work of the war period, is information as to the failures of parts that act as warnings to do something different; but it is practically beyond the compass of gas engineers, in these days of exigent work and persistent worry, to explore the diffuse publication on benzol extraction to obtain hints as to the construction of a home-made plant, though probably even this would in the end save a large amount of trouble. Apart from counsel regarding the general scheme, information as to the proportions of plant, heating surfaces, coils, and tubes for dealing with a given make of gas, with indications as to the materials that should not be used, some particulars as to working temperatures, a general statement as to the quality of the oil that should be employed, and the percentage of naphthalene in it which is not likely to cause trouble, and other points, would go a long way to help engineers of small works in this matter, and to induce others to try to do more than is being done at present with oil-washing. Mr. H. O. Carr recently circulated a very useful description of some such plants. But it does not appear to be anybody's business to do what we have suggested, and so there is wandering along in the same old way of not doing anything at all, or of imposing upon

the willing workers in the small works the task of themselves finding out as much as possible by the tortuous process of trial.

In a paper read before the Midland Junior Association last Thursday, Mr. C. F. W. Rendle, of Redditch, described a plant built there wholly (excepting the tank pits) from discarded plant that had no use on the works; and we feel certain that, prior to the work being entered upon, had more information been available in concise form, some of the difficulties experienced with this home-made plant would have been avoided *ab initio*, notwithstanding that the engineer was limited by the spare apparatus at his disposal. But practically every one of the difficulties described had its seat in detail, and not in the general arrangement; and to some extent they were all due to the degenerated state of parts, which is a trouble that must be safeguarded against with plant that may have been disused through age, and will therefore probably soon develop rupture or pitting. If provision, too, had been made from the first for unequal expansion as between the internal tubes and the outer shell of the heat interchanger, trouble from fracture and low efficiency would have been avoided there. The advantages, too, of facilities for checking oil levels and flow were found by experience, as were the means afterwards adopted to reduce the formation of emulsion. So from the beginning, success has been gradually built-up by experiment with the parts available, and the plant is not doing badly now. It is able to take credit for a production of about 2 gallons of 65's crude benzol per ton of coal carbonized; and there is to-day every confidence in the plant, notwithstanding the economy of its construction.

Of course, it is somewhat difficult in these times to get washing oil always exactly as one would desire it; and some of the trouble at Redditch has been due to this cause. The naphthalene content should be as low as possible, and not exceeding 5 to 7 p.ct. if trouble is to be avoided. In the concluding part of his paper, Mr. Rendle states his preferred construction of still and heat interchanger. He also touches upon the question of the construction and position of the oil-washing plant. The fact that one cannot ensure the benzolized oil being free from ammonia or sulphuretted hydrogen or both, makes it necessary to exercise care as to the materials used in vital parts which are liable to attack; and this, too, is a good reason for placing the oil-washing plant after the purifiers, or, if this is impossible, as may sometimes be the case in small works, after the scrubber. Another reason for putting the plant subsequent to the purifiers is that the carrying forward of oil by the gas impairs the efficiency of the purifying material. Mr. Rendle also desires to know more about the future aspect of benzol recovery. We do not think there is any need to worry much about that. Whatever the nature of the prognostications, they must be more or less hypothetical. One can only judge by the probabilities and the available signs. One sees that there is not the slightest likelihood of the world's output of petrol keeping pace with the world's output of motor cars and other spirit-propelled vehicles, and the requirements in other directions. As a matter of fact, America confesses that its new output is not proceeding *pari passu* with demand and the decline of the production from existing sources. There is not the least doubt that the demand for motor spirit and the requirements of our home industries for benzol will give all the scope that the gas industry will require in future for the marketing of its production.

Coke and the Relief of the Railways.

One result of the propaganda instituted by the London Coke Committee to promote the use of locally produced gas coke in lieu of coal as fuel, has been to relieve to no inconsiderable extent the coal traffic on the railways serving the Metropolis. The extent to which this useful work has been carried will be more fully appreciated in view of the fact that, in the present congested state of traffic, a coal-wagon, which in normal circumstances will make about three double journeys per month, can now make only one-and-a-half to two double journeys. It will be seen, therefore, that for each steam-boiler of average capacity consuming 1000 tons of coke per annum instead of rail-borne coal, about ninety double wagon journeys, together with the necessary locomotives, rolling-stock, maintenance, &c., have been saved. In the aggregate, the quantity of coal so displaced in the London area now amounts to about 250,000 tons a year, and, with the increasing restrictions upon shipping, surplus coke hitherto exported, and now being put into stock at London gas-works, might usefully be employed in this direction.

Inert Material and Steam-Raising.

Factors which very considerably operate against the consummation of the Coke Committee's desirable object are the increasing difficulty experienced by gas undertakings of obtaining adequate supplies of coal, and the very indifferent quality of a large portion of the available supplies. In its incidence, the largely increased ash content of the coal still reaching gas-works in the Metropolis is by far the more serious in its pernicious effects. Analyses reported from various quarters show an increase of 10 to 15 p.ct. or more in the pre-war average ash content. The seriousness of the corresponding wastage in tonnage, wagon journeys, haulage, and labour cannot, in the present circumstances, be overstated. The direct effect of abnormal ash content in gas coal upon the supply of the raw material for high explosive munitions of war, should be sufficiently obvious to warrant immediate action being taken to eliminate, so far as possible, the rubbish now generally blended with coal consigned to gas-works in the London and southern districts. It has already been pointed out that the effect of such material upon the working and capacity of the retorts is considerably more than is represented by the proportionate increase over the normal ash content. The resultant coke, which necessitates more frequent clinkering of the fires, also materially affects the working of steam-boilers; and new outlets for coke as fuel for steam-raising, which have been secured entirely on its economic merits, are now seriously threatened by competition with raw coal. This is a matter of very substantial gravity for the gas industry; for present experiences must largely affect the future business.

Permits for Gas Supply to Motor Vehicles.

The intention is pretty clear of the new motor Order in relation to the use of gas, though some parts of it appear to be superfluous, as no gas undertaking would engage to supply motor vehicles with gas if this was likely to jeopardize the service to their ordinary consumers. They would simply leave the business to those gas undertakings whose surplus producing capacity enables them to take on the additional load. However, the obvious intention of the Order is to make gas more than ever a substitute for petrol, and not merely an auxiliary to it; and by this means ensure the best possible use of both motor fuels. Gas is now placed under the same restrictions as petrol; and purpose of use will largely control the issue of permits. This means that joy riding or personal convenience will be interdicted, and the use of gas like petrol be only allowed for practical and beneficial purposes. Permits for gas will, after a month's time, be as essential as permits for petrol, though there will be no limitation at present as to the quantity of gas that may be purchased where a permit is granted. But the permit will confer no right to demand gas, which will be subject to the capacity of the undertaking to supply. Therefore gas undertakings will shortly have to see that motor vehicle owners have the necessary permit issued by the Petrol Control Department, although there is no obligation upon them to sell for this purpose if they cannot afford to do so. It will be seen that there are quite a number of restrictions as to the motor vehicles for which permits will be granted; but this is not the business of gas undertakings—their authority to supply will begin and end with the production of the necessary permit. It will be seen that those who use gas for motor purposes will have to continue to use it, for there is to be no duplicating of permits for the same car, so that the owner may have the option of using petrol or gas, though a small quantity of petrol will be allowed to the users of gas for emergency purposes. However, there does not seem to be any reason for limiting the permits for gas in respect of cars that are to be employed for useful purposes, in view of the fact that there is no compulsion to supply, if the conditions of the ordinary supply do not admit of it.

British Association of Chemists.

It is gratifying to learn from Mr. T. F. E. Rhead, of the Nechells Gas-Works, Birmingham (Joint Hon. Secretary, with Mr. R. E. Crowther, of Heaton Chapel), that the proposed formation of the British Association of Chemists has met with strong

support, and produced great interest among members of the profession. The first report of the Executive Committee who have the movement in hand shows that the inaugural meeting in Manchester last November was attended by about 700 chemists from all parts of the kingdom, who were agreed upon the advisability of creating such an Association, and resolved to form at once a Provisional Society for furthering the project. Membership of the Society was to be confined to (*a*) any person holding a university degree (or its equivalent) with chemistry as principal subject; and (*b*) any person who can show evidence satisfactory to the Council of having had a sufficient general education, and of having practised pure or applied chemistry for not less than seven years, and who now holds a responsible position—the latter clause only to apply prior to Dec. 31, 1921. It is stated that this definition of a "chemist" was only agreed to provisionally as a working basis for forming the Provisional Society. The objects of the Association are such as will doubtless appeal strongly to chemists generally: To obtain power to act as sole registration authority for all chemists; to have the word chemist legally redefined; to safeguard the public by obtaining legislation ensuring that certain prescribed chemical operations be under the direct control of a chemist; and to raise the profession of the chemist to its proper position among the other learned professions, so that it may attract the attention of a larger proportion of the best intellects, and thereby secure a supply of highly-trained chemists adequate to the industrial needs of the country. A committee has been appointed to draw up a draft constitution and articles of association; and meanwhile chemists requiring further information may be advised to address themselves to Mr. Rhead. The next general meeting is to take place on the 9th prox., at Manchester.

Home-Produced Oil.

There have been many murmurings from the advocates of low-temperature carbonization, and from a good many people who do not know much about the matter, over the fact that the Government have not done anything that is visible to develop the production of oil by aiding in the construction of plants for dealing with rich oil-producing cannels and other coals; but they do not take account of the difficulties of the Government. Sir L. Worthington Evans, M.P., Parliamentary Secretary to the Ministry of Munitions, seemed to be dealing with the grumblers when he pointed out the other day that, apart from serious technical difficulties, the requirements of urgent war services for labour and materials render impossible the rapid development of methods which might perhaps otherwise be pursued with advantage. There is a shorter way to results than by putting up new plant; and this is the one which Sir Worthington says has been steadily followed by the Ministry of Munitions—that is, by utilizing to the fullest extent existing carbonizing plants. This was supplemented by the statement that all the existing plant at the shale-works of Scotland, and at the gas-works and coke-ovens throughout the country, are being pressed to their full capacity, and are being extended as far as present circumstances will permit. So far as the gas industry is concerned, while it is putting all available resources at the service of the nation, "present circumstances" appear to have permitted of very little indeed being done in the way of plant extensions with fuel oil or any other production in view. It is also gathered that experiments have shown that certain plants already in existence can be adapted in a short time to treat new material by new methods; and this adaptation is being actively pursued. Again, it would be interesting to know in which direction this is taking place. Then, "on the other hand, where suitable material cannot be dealt with on existing plants, arrangements are in progress for erecting works for the extraction of oil." We believe this correctly defines the position, and that the work still loiters about preliminary arrangements. Among other statements is the one that retorts at various gas-works would be utilized for the production of oil from coal, and that this would not have the effect of reducing the quality of the gas. There was a hint in which gas undertakings will be interested, to the effect that, if munition works would use creosote and pitch as a substitute for fuel oil, quantities of oil would be released for essential war purposes. The trouble is that the use of creosote is a matter for a permit; but as to pitch, the gas industry will be happy indeed to see any revenue-yielding application made of this plentifully stocked product.

PERSONAL.

At a meeting of the Dundee Town Council, it was agreed to increase the salary of Mr. ALEXANDER YUILL, the Gas Engineer, by £100 per annum.

Private H. BURROWES, who has been given a Commission in the Royal Irish Rifles, was the Assistant Manager of the Earby (Yorks.) Gas Company.

Second-Lieutenant W. DAWES, R.G.A. (S.R.), is placed on the Retired List, on account of ill-health contracted on active service. Mr. Dawes has also, for the same reason, resigned his position as Assistant to the Normanton Gas Company.

Mr. C. W. OFFORD has resigned the position he has held with the Tottenham District Light, Heat, and Power Company since the absorption by them of the Enfield Gas Company, of which Mr. Offord was for many years General Manager.

Friends will be pleased that Mrs. W. E. PRICE, of Hampton Wick, who recently sustained severe injury as the result of an accident while cycling, is progressing favourably, and is much stronger. It is hoped very soon to get her removed from the hospital to a nursing home.

The name of Major OSWALD B. F. PLANCK appears in the "London Gazette Supplement" of Jan. 1, in the list of Army Honours, as being awarded the Distinguished Service Order. Major Planck was a member of the staff of Messrs. Stewarts & Lloyds, Ltd., before joining the army.

Surgeon-General Sir ALFRED KEOGH, G.C.B., M.D., F.R.C.P., who will be remembered specially by "JOURNAL" readers as having been President of the Society of British Gas Industries, is retiring from the position of Director-General of Army Medical Services, for the purpose of resuming his duties as General Executive Officer to the Imperial College of Science and Technology, in connection with which there is much work of national urgency to be done.

Mr. and Mrs. JOHN JAMES COOKE, of East Ardsley, celebrated their golden wedding on Christmas Day; and in honour of the event the Directors of the Gas Company presented them with a beautifully engraved silver rose-bowl. Mr. Cooke has had a career extending over half-a-century in the gas profession. He was 36 years with the Heckmondwike and Liversedge Gas Company, and has for 14 years occupied his present position as Manager of the East Ardsley Gas Company.

The Burton-on-Trent Town Council have adopted a recommendation of the Gas Committee to increase the salary of Mr. R. S. RAMSDEN, the Gas Manager, by £50 per annum. Alderman T. E. Lowe, in bringing the matter forward, said the Council ought to bear in mind that there were few better results of gas-works trading; Burton comparing very favourably with the best of other towns, whether the concerns were owned by a company or by the local authority. Mr. Ramsden was a hard-working, zealous official, and had the interests of the whole undertaking thoroughly at heart.

Among the appointments to the Order of the British Empire (notified in the "London Gazette Supplement" of Jan. 7, for services in connection with the war, we are pleased to see the name of Mr. W. DOIG GIBB, who has been made an Officer of the Order (O.B.E.). Mr. Doig Gibb appears in the list as Consulting Gas Engineer to the Explosives Supply Department, Ministry of Munitions. Mr. FRANK ELIOT WILLIAMS, who has been appointed O.B.E., is a member of the London staff of the Imperial Continental Gas Association. Soon after the outbreak of the war, his services were lent by the Directors to the Government, in response to an inquiry for men with a knowledge of languages. He has served in the War Trade Intelligence and the War Trade Department, and is now Chairman of one of the Licensing Committees of that Department. He is the son of Mr. William Williams, the Managing Director of the European Gas Company, Ltd. There also appeared the name of (now) Sir PERCY KENDALL STOTHERT, the Deputy-Chairman of the Bath Gas Company, who is Chairman of the West of England Board of Management, Ministry of Munitions.

OBITUARY.

Mr. A. J. Harrison, the Gas Manager to the Padiham District Council, has received intimation that a younger brother, Lieutenant BERNARD HARRISON, of the R.F.C., was killed at a camp in Lincolnshire, while flying. He was only 22 years old. There were five brothers, all of whom, along with their father, have been connected with the management of various gas works.

Midland Junior Gas Association.—As an addition to the programme mapped out, the Council have arranged a special meeting, to which ladies will be invited, for Saturday evening, Feb. 23, in the reading-room at the Council House. A lantern lecture, in popular vein, on "How Gas is Made and Used," will be given by Mr. E. W. Smith, M.Sc., F.I.C., Chief Chemist to the Birmingham Corporation Gas Department; and this will be followed by refreshments and a musical programme. A special circular will be issued shortly; and the Council are hoping that the meeting will be well attended.

GAS BILLS FOR 1918.

[THIRD ARTICLE.]

TO-DAY we give the third instalment of our review of the Bills that are being promoted for the ensuing session of Parliament.

The Hampton Court Gas Company propose that, as from Dec. 31, 1917, and until Dec. 31 in the year following the termination of the present war, and during such further periods as the Board of Trade may from time to time direct, having regard to the then conditions and the cost of labour and material, they shall not be under an obligation to reduce the dividend below the standard rate of dividend, except to the extent of 3d. on every £100 of consolidated ordinary stock in respect of each penny or part of a penny increase of price above the standard price, which amount of 3d. shall be substituted for the 1s. 3d. in section 32 of the Act of 1903 [Dividend Dependent on Price] so far as the section provides for the reduction in the rate of dividend. The standard price is 3s. 6d. The Company also ask to be entitled to charge in respect of all gas supplied for use for the purposes of, or in connection with, mechanically propelled vehicles, any sum not exceeding 2s. per 1000 c.ft. in addition to the price chargeable for the supply of gas for other purposes. Powers as to annual meetings and interim dividends are also sought. The Company further desire authorization to enter into agreements with any company or local authority having statutory powers for (*a*) the generation by the Company of electrical energy for the supply thereof to the company or local authority; for (*b*) the supply of heat or power or any means of producing heat or power on such terms and conditions as may be agreed upon; and for (*c*) the provision of capital or funds by either party for any of these purposes. [*Parliamentary Agents: Messrs. Batten, Proffitt, and Scott.*]

The Hastings and St. Leonards Gas Company propose that, notwithstanding anything contained in sections 24 and 25 of their Act of 1899, they shall not, as from Jan. 1 this year, and during the period prescribed, be required, in consequence of any increase for the time being in the price of gas, to reduce any dividend payable by them by a greater amount than 20 p.ct. of the difference between the amount of the dividend which, but for the passing of the present measure, it would have been lawful for them to pay and the amount of the dividend paid by them for the half year immediately preceding the declaration of the present war. It is contemplated that the section shall remain operative until the expiration of the fifth year following the declaration of peace, with power to the Board of Trade to make an extension. The Company also ask to be authorized to place such reserve price as they may think fit upon any stock which they may issue in lieu of the provision as to the reserve price not being less than the nominal amount of the stock, and to dispose of any stock not sold in such manner as the Directors may determine for the purpose of realizing the best price obtainable. Notwithstanding anything contained in section 25 of the Act of 1883, the Company desire that any debenture stock created and issued after the passing of the present Bill, and any debenture stock previously created but not issued, shall bear interest at such rate not exceeding 6 p.ct. per annum as shall be prescribed by resolution of the Company in general meeting. [*Parliamentary Agents: Messrs. R. W. Cooper & Sons.*]

The Liverpool Gas Company have, by their Act of 1914, a standard price of 2s. 1d.; but reduction of dividend does not commence until the price of 2s. 4d. has been reached, while increases of dividend begin on decrease of price below the standard figure. The issued share capital consists of £2,498,905 ordinary stock, entitled to a dividend of 5 p.ct. per annum, subject to the sliding-scale. Owing to the abnormal conditions created by the war, the Company are unable to supply gas at 2s. 4d. per 1000 c.ft., and therefore the dividends have had to be reduced. The clauses by which temporary relief is sought have distinct features from others. They provide:

2. (1) In respect of the year 1918 and every subsequent year or half year during which the total cost to the Company of the manufacture and distribution of gas, and incidental to the consumption thereof, shall per 1000 c.ft. of gas supplied exceed the like cost during the year ended the 30th day of June, 1914, by reason of any conditions arising directly or indirectly through the present war (which excess cost is hereinafter referred to as "the war excess cost"), the authorized rate of dividend which may be paid on the ordinary stock of the Company shall be calculated as though there were added to the price of 2s. 4d. per 1000 c.ft. mentioned in section 30 [Price of Gas—Sliding-Scale] of the Act of 1914, a sum per 1000 c.ft. (hereinafter called "the war relief addition") which shall be determined under the provisions of subsection (2) of this section, and the Act of 1914 shall be read and have effect accordingly.

(2) The war relief addition shall be 1s., provided that if at any time the Company or any local authority whose borough or district is wholly or partly situate within the limits of supply shall make representation to the Board of Trade (in this section referred to as "the Board") that the war excess cost is greater or less than the sum of 1s., the Board may by order increase or decrease the war relief addition as they may think fit so that the war relief addition may approximately equal the war excess cost; and the Board shall by such order determine the date as from which such altered war relief addition shall come into force. The Board may, on a like representation, make any further order or orders repealing or amending any previous order made by them under this subsection.

(3) Before making any order under subsection (2) of this section, the Board shall give an opportunity to the Company and any such local authority as aforesaid of being heard in support of or against the granting of any such order, and may, if they think fit, appoint an accountant to inspect any books and accounts of the Company, and to report to the Board what is in the opinion of such accountant the war excess cost of manufacture for the time being, and the reasonable expenses incurred by the accountant in making such inspection and report shall be paid by the Company.

(4) The provisions of this section shall cease to have any force or effect as from the end of the year terminating on or next after the expiration of a period of two years from the termination of the present war, or as from such later date as the Board may, on the application of the Company, and having regard to any continuance or partial continuance of the abnormal conditions brought about by or originating in the course of the war, determine by order made on such terms as the Board may think fit.

There follows the clause amending the one in the Act of 1914 referring to the issue of preference stock. The Company desire the words "not exceeding, except with the consent of the Board of Trade, the rate of 7 p.ct. per annum" to replace the ones "not exceeding the rate of 5 p.ct. per annum." Powers will be asked to issue redeemable preference and debenture stock. [*Parliamentary Agents: Messrs. Rees & Freres.*]

The Longwood and Slaithwaite Gas Company have a standard price of 3s. 1d. From 1912 to 1914, they were charging 2s. 6d. per 1000 c.ft., which allowed the payment of a dividend on the consolidated ordinary stock at the rate of £5 17s. 6d. p.ct. War conditions have necessitated the raising of the price to 3s. 3d., and the lowering of the dividend to 4¾ p.ct. Costs are still ascending. The Company therefore ask for relief, by having it enacted that section 25 of the Longwood Gas Act, 1902, shall be read and have effect as if the standard rate of dividend on the consolidated ordinary stock issued before Jan. 1 this year had been £5 17s. 6d. p.ct., and section 26 of the Act of 1902 be read and have effect as if the reduction in the rate of dividend payable in respect of each penny or part of a penny by which the standard price is increased had been 3d. p.ct. instead of 1s. 3d. It is further provided that any consolidated ordinary stock issued after Jan. 1 this year and during the continuance of the present measure may bear, either permanently or for such period as may be specified, a dividend at a rate not exceeding 6½ p.ct., or such higher rate as the Company, with the consent of the Board of Trade, may determine; and this rate is to be deemed to be the standard rate. Except in regard to this last-mentioned matter, the present measure, it is proposed, shall have effect during the continuance of the war and two years from its termination, or for such extended period as the Board of Trade may direct. [*Parliamentary Agents: Messrs. Torr, Durnford, & Co.*]

The Maidenhead Gas Company are asking for additional powers in regard to capital and other matters, including an amendment of the provisions as to the standard price. The authorized capital is £116,800, of which (including premiums) £92,539 has been raised by the issue of consolidated stock with a standard rate of dividend of 5 p.ct. per annum. The Company are also authorized to borrow on mortgage or to raise by the issue of debenture stock £25,000, of which £14,800 has been borrowed or raised by the issue of mortgage debentures bearing interest at 4 p.ct. per annum. In the clauses, lands and new works powers are sought; and attached to these are the provisions as to the working-up and purchase of residuals, including the one-third restriction. The amount of additional capital desired is £30,000 on the part of which issued as ordinary capital 5 p.ct. is to be paid, and on the part issued as preference not exceeding 6 p.ct. Borrowing powers are proposed in the usual proportion of one-third; and it is asked that section 20 of the Company's Act of 1900 shall be amended to enable the Company to borrow the equivalent of one-third part of the capital raised under that Act. Powers are requested to the issue of redeemable preference shares or stock or debenture stock. Authorization as to a special purposes fund and the granting of pensions is asked for. As to the standard price, it is proposed that section 34 of the Act of 1900 shall be read and construed as if 4s. 6d. were substituted for 4s. and 4s. 9d. for 4s. 3d., provided that the Board of Trade may after 1920, on the application of any local authority within the limits of supply, or of the Company, modify these changes, and again make revision after the expiration of three years. Among a large number of miscellaneous clauses of normal character nowadays, are powers to purchase crude or partially purified gas, to allow differential prices, to hold annual meetings, to pay interim dividends, and to institute a profit-sharing scheme. [*Parliamentary Agents: Messrs. Sherwood & Co.*]

The Maidstone Gas Company are not proceeding with the Bill of which they gave notice.

In the preamble of the Bill of the Newcastle-upon-Tyne and Gateshead Gas Company, it is stated that the issued capital of the Company consists of £250,166 of 4 p.ct. preference stock and £1,875,892 ordinary stock. The standard rate of dividend on the ordinary stock is 3½ p.ct. per annum, subject to an increase by 2s. 6d. p.ct. per annum for every penny for the time being charged by the Company for gas supplied by them within the city below the price of 2s. 9d. By virtue of the Act of 1879, the maximum prices chargeable by the Company for gas supplied by them within the city and outside respectively are 3s. 4d. and 4s. per 1000 c.ft. The price charged for gas in the city in the half year ending on June 30, 1914, was 2s. 1d., at which price the authorized rate of

dividend in respect of the half year upon the ordinary stock was 4½ p.ct. per annum. Owing to causes attributable to the war, the Company have been compelled to increase the price to such an extent that the authorized rate of dividend in respect of the half year ending on Dec. 31, 1917, was reduced to £3 18s. 9d. p.ct. per annum; and a further increase in price and reduction in dividend are inevitable. Under these circumstances, the Company propose that, as from Jan. 1, 1918—

(*a*) Section 13 [Standard Rate of Dividend] of the Newcastle-upon-Tyne and Gateshead Gas Act, 1879, as amended by section 7 [Standard Dividend on Ordinary Stock] of the Newcastle-upon-Tyne and Gateshead Gas Act, 1901, shall be read and have effect as if £4 6s. were substituted therein for £3 10s., and as if 6d. were substituted therein for 2s. 6d.

(*b*) The maximum prices which the Company may charge under section 14 [Maximum Price of Gas] of the first-mentioned Act for gas supplied by them shall be increased by 6d. per 1000 c.ft., or such larger amount (if any) as the Board of Trade may from time to time, on the application of the Company, by order prescribe.

The provisions of this section, it is proposed, shall cease to have effect from the end of the half year terminating on or next after the expiration of twelve months from the conclusion of the present war, or such longer period (if any) as the Board of Trade may think fit. [*Parliamentary Agents: Messrs. Dyson & Co.*]

The issued capital of the Plymouth and Stonehouse Gas Company now consists of 7000 shares of £10 each, entitled to a standard dividend of 7½ p.ct. per annum, 3000 shares of £10 each entitled to a standard dividend of 7 p.ct., and £188,120 of ordinary stock entitled to a standard dividend of 5 p.ct. The Company have issued 3 p.ct. debenture stock to the nominal amount of £50,000, 3½ p.ct. debenture stock to the amount of £20,000, and 5½ p.ct. debenture stock to the amount of £22,000. The standard dividends upon the 7½ p.ct. and 7 p.ct. shares respectively are subject to increase or reduction by 5s. p.ct. per annum, and the standard dividend upon the ordinary stock is subject to increase or reduction by 2s. 6d. p.ct. per annum for each penny by which the price per 1000 c.ft. is below or above the standard price of 2s. 6d. In respect of the parishes of Tamerton Folliot and Egg Buckland and Plymstock, the standard price for the purpose of determining the authorized rate of dividend from time to time on the ordinary stock is 3s. 6d. The price charged in Tamerton Folliot and Egg Buckland in the half year ending on March 31, 1914, was 2s. 1d., in Plymstock 2s. 5d., and in the remainder of the area of supply 1s. 9d., at which prices the authorized rates of dividend on the 7½ p.ct. shares, the 7 p.ct. shares, and the ordinary stock were respectively £9 15s., £9 5s., and £6 2s. 6d. p.ct. per annum. Owing to war causes, the price of gas has had to be increased to such an extent that the authorized rates of dividend were in respect of the half year to Sept. 30, 1917, respectively reduced to £6 10s., £6, and £4 10s. p.ct. per annum; and it is inevitable that a further reduction of dividend will have to be made. Therefore the Company propose that in respect of the half year ending on March 31, 1918, and any subsequent half year during any part of which the price per 1000 c.ft. charged for gas supplied elsewhere than in the parishes of Tamerton Folliot, Egg Buckland, and Plymstock shall exceed 1s. 9d., shall be at such respective rates per cent. per annum as the Company may from time to time determine, not exceeding (*a*) In the case of the 7½ p.ct. shares, a rate less than £9 15s. by 1s., (*b*) in the case of the 7 p.ct. shares a rate less than £9 5s. by 1s., and (*c*) in the case of the ordinary stock a rate less than £6 2s. 6d. by 6d., in respect of each penny or part of a penny by which the price exceeds 1s. 9d. It is proposed that this provision shall cease to have effect as from the end of the year terminating after the expiration of two years from the close of the war, or such longer period as the Board of Trade sanction. [*Parliamentary Agents: Messrs. Dyson & Co.*]

In their Bill, the Pontypool Gas and Water Company are asking for further powers in respsct of their gas and water undertakings, and for authority to acquire (under an agreement already entered into) the local Electric Light and Power Company. The 10 p.ct. stock and £12 shares issued amount to £26,400, and by issuing 7 p.ct. shares of £10 each £99,110 has been raised. Of the authorized capital there remains £29,490 of the 7 p.ct. class to be issued under the Act of 1909. Of 4 p.ct. debenture stock, £27,095 has been raised; and of the authorized sum there is still in hand £17,905. The capital of the Electricity Company consists of £5715 in shares of £5 each fully paid; and the Company have issued £5000 of debentures for the purpose of securing the repayment of sums amounting to £3500 or thereabouts borrowed by them. Following on the powers relating to the water undertaking, there are a number of more or less ordinary clauses referring to the gas undertaking. Among them a calorific standard of 475 B.Th.U. is asked for in place of the illuminating power standard, with a minimum pressure of gas of not less than 15-10ths. Residual products purchase powers are also sought. Succeeding are the clauses as to the transfer of the electricity undertaking, with the necessary authorization as to supply. The holder of two or more fully paid-up shares in the capital of the Electricity Company is to receive £5 of 7 p.ct. stock for each share, while the holder of a single fully paid-up share is to be paid £5 in cash for it. The Bill provides for the creation of the necessary nominal amount of 7 p.ct. stock. Additional land and works powers are desired for the electricity undertaking. Returning to the general capital of the Company, conversion into a uniform 7 p.ct. stock is sought; and the holders of every £7 of 10 p.ct. capital are to receive £10 of 7 p.ct. stock, and so in proportion, and for each 7 p.ct. share £10 of 7 p.ct. stock. In addition to the 7 p.ct. stock to be created and issued to the holders of shares in the Electricity Company and of shares or stock in the Gas and Water Company, powers for £30,000 additional capital are sought. The Company ask for borrowing powers under their Acts of 1873 and 1890 to the extent of a further sum of £6600, also in respect of the 7 p.ct. stock to be created in substitution for the shares of the Electricity Company the sum of £1900, and one-third part of the amount of capital authorized by the present measure. Sanction to the issue of redeemable preference capital and debenture stock is sought, together with authorization as to a redemption fund. Powers for holding annual meetings and granting pensions are included. [*Parliamentary Agents: Messrs. Rees and Freres.*]

ELECTRICITY SUPPLY MEMORANDA.

THE first shock to the electricity supply industry of the issue and the contents of the report of the Coal Conservation Sub-Committee on Electricity Supply having subsided, the flood gates of approval and criticism have now been opened. The approval comes largely from electrical journalists; the criticism from municipal quarters. For most part, private enterprise is silent. The "Electrical Review" regards the report as of the first importance to the electricity supply industry. The "Electrical Times" also assesses the report as being the "most important" ever published in the history of the electrical industry. But it sways over from this attitude of appreciation to an acknowledgment that it sees "not a few omissions and weak points in the report;" and this is the conclusion of a good many other people. Perhaps the most striking weakness is the hand of the strong man in the report. Everybody appears to realize, without any further information than the lines and the spirit of the report itself, that from conception to finish Mr. C. H. Merz predominates, and that his performances in the North-East area of the country under extraordinarily favourable conditions are the ones that are held up as the examples of highest intrinsic brilliancy of what is required for the regeneration of electricity supply in this country. But the trouble is that the rest of the country cannot boast of the same benign circumstances, which fact undermines any attempt to utilize as an examplar the important patch of the country upon which Mr. Merz has made a big impression with (as not insignificant collaborators to success) the conditions that exist there. It is Merz *plus* conditions, and not Merz only. It is now clear that the report might have been of a more diplomatic order. It has combed the wrong way most people concerned in electricity supply, except the electrical journalists, who are fortunately not responsible for the design and running of electrical stations. The sweeping condemnation of all existing electrical practice, except (say) on the North-East Coast, is not relished by electrical practitioners of the country. There is much in the report that is hypothetical; and there is much in it that is theoretical—this applying especially to the economies and the savings that are predicted from the desired course of reformation. The report, in fact, is a challenge from practically one source to the whole of the remainder of electrical ability that has been exercised in making the possible development under varying topographical conditions.

The Strong Man and Exceptional Conditions.

There is resentment. This is not surprising. It comes from local authority representatives, North, South, East, and West. The "Electrical Review" looks at the matter as a proposition to replace the parochial system of innumerable independent electrical supply undertakings by an entirely new organization of a national character and of gigantic dimensions. "Innumerable!" There are 637 electricity undertakings mentioned, 312 of which are under company administration, and 325 municipal. That is not the only way to consider the report. It must be contemplated from "A" to "Z"—first from the technical standpoint, and then from the financial and commercial ones. It is not solely a question of wiping-out the uneconomical generating stations, or of reducing the number of stations. There are many other things to be considered, including alternatives to the super-generating station, not forgetting the costs of transmission and distribution, all of which are ignored in the report, which shows fixed and irrevocable opinions of practically one mind. The municipal critics find in the report a distinct anti-municipal bias, and a leaning towards company enterprise, to which it attributes initiative and resource, freedom of range, and keenness. And we agree that these are qualities that are conducive to the fullest commercial success. At the same time, while we do not approve of all the policy adopted by municipalities, we are far from taking the view that these qualities are alone the property of private enterprise; for in connection with gas supply we have found them also the property of the technical men serving municipal authorities and of many members of gas committees. But there is regret that their wise recommendations are so often negatived by the superior decisions of men on the councils who are animated by other motives than the best service from the trading undertaking, whatever its nature. Alderman G. Pearson, the Chairman

Municipal Resentment.

of the Bristol Corporation Electricity Committee, and Mr. H. Faraday Proctor, the Engineer—the one the Solicitor, and the other the Hon. Secretary, of the Incorporated Municipal Electrical Association—have protested against the issue, while the Board of Trade Committee on Electric Power Supply are sitting, of a report which favours company working as against municipal operation. But it must not be forgotten that there was a certain amount of rage exhibited, at the time of the appointment of the Board of Trade Committee, that this report of the Coal Conservation Sub-Committee of the Reconstruction Committee was being held back from public scrutiny. Now that it is published, it does not meet with approbation. It is, however, perfectly clear that the municipal authorities will never consent to the establishment of large private companies to be their generators and suppliers of current, and leave the municipal authorities simply in the position of electrical shopkeepers. The Sub-Committee anticipated the hostile attitude on the part of the municipal authorities; for in Lord Haldane's preface to the report (of course, his Lordship now knows all about the electrical requirements of the country and how to meet them, just, as he learned a time ago how much better than this country Germany did certain things, which shows the marvellous capacity of his mind), he remarked that, whatever conflict there may be between the interests of local electrical authorities which exist at present and the interests of a comprehensive scheme, there is no conflict in this matter between the interests of a local community and those of the nation as a whole. This is a platitude of quite an acceptable nature; but it does not prove that the comprehensive scheme airily delineated is precisely the one that is the best for the interests of a community or of the nation as a whole.

Revolution or Sane Development.

Some of the electrical papers are talking as though the report utters the final word on what is required for reformation. If it did this, the Board of Trade Committee would not be sitting, nor would the Sub-Committee on Coal Conservation have acknowledged that what they recommend is all subject to Government investigation and approval. The unanimity found in the present report is eloquent of the incapacity of some of the members of the Committee to set themselves in opposition to the Merz ideals. But assuming that super-stations are the only way of raising the economic status of the electricity supply industry, how long is it going to take to bring them into being? There is much loose talk about the part the electricity industry is going to take in the industrial boom after the war—talk of how it is going to largely influence production, and enable our manufacturers to compete abroad. This is all very fine. We have no doubt whatever that it will do its share; but the extent of the share will depend upon conditions. What is happening? The industry, like all the other industries, has not the capital, men, or materials with which to develop now. Electrical plant in the industrial areas is being run to full capacity; its depreciation is going on apace; and there is no help for it. If super-stations, with huge coal carbonizing and generating plants, and intricate and expensive transmission systems, could be constructed now, so could the best of the existing stations be assisted to prepare, with greater expedition, for a larger output. But neither the one nor the other can be done. Whatever the final determination of the Government—and it may be the determination will be that the line of development must preferably be, in the national interests and coal conservation, in conjunction with the existing carbonizing industries—it cannot be taken up this side of the termination of the war. Moreover, a revolution of existing systems cannot be brought about with the lightning rapidity of a Russian revolution. Any attempt at that sort of thing in connection with electricity supply will only mean destruction, chaos, and a permanent burden of waste. The work anyway, whatever its nature, will have to be done piecemeal. There is no other course. All intelligent men will admit the truth that the period immediately following the war will be the one in which industrial reconstruction, revival, and expansion will be decided; but this will be upon existing conditions in their case. In that of the electricity supply industry, such recommendations as those in the report of the Sub-Committee on Coal Conservation mean to all intents and purposes starting *de novo;* and such a change will be a matter of years—not a miraculously quick transition from one state to another.

Cheap Fuel and Small Stations.

In the midst of all this attempt to concentrate attention on the super-station, what is actually being done with smaller generating stations, especially working in conjunction with gas undertakings, should not be overlooked. Mr. J. W. Napier once interested the electrical industry with an account of what he has been able to accomplish at Alloa by running the electrical supply in conjunction with the gas-works. As he now points out, in a letter to the "Glasgow Herald," there are small stations which have shown enterprise where cheap fuel is available; and the circumstances of electricity supply at Alloa in this respect are not without interest. The Corporation gas and electricity works occupy sites adjacent to each other. At the gas-works the introduction of up-to-date carbonizing plant, and the recent changes in the quality of gas supplied from an illuminating power basis to that of heat value, have enabled increased values of products to be obtained, among them coke of a particularly suitable quality for use in producer gas plant at the electricity station. The producers used are equipped with vertical gas-engines; the result being that about 2000 tons of raw coal are thereby being saved in electricity generation, and at the same time a convenient outlet is provided for gas coke. Incidentally, the production of fuel practically on the site of the electricity station saves transport of material over the railways. In the particular local circumstances of electricity supply in Alloa with a gas-engine-driven plant of 1200 KW., it is claimed that a scheme of centralization, or interlinking of supply, would be found opposed to the practical economics of electricity generation, having regard to the conservation of coal, and the recovery of residuals of commercial value and important national interest at the present time. Not only so, but the effect, in Mr. Napier's opinion, would be that the price of electricity to consumers in the Alloa area would be increased. In proof of the undoubted economy resulting from the sequence of operations carried out in the gas and electricity works from the scientific treatment of raw coal to the transmission of electrical energy, a comparison shows that fuel costs alone per unit sold at Alloa are the lowest in Scotland. Mr. Napier recently had occasion to make comparison of costs of electricity supply at the low rates charged to consumers in Alloa with the prices for current supplied from certain large stations. Hoping it would not disturb unduly the equanimity of mind of the chief officials of the Clyde Valley Supply Company and the Glasgow Corporation, he stated that he was not surprised to find that in the case of three engineering works of small, medium, and large demand, the total cost per annum for current from the Company and Corporation named was very sensibly greater than the cost of supply afforded from the Alloa station. The data took into account coal clauses and war charges. This result should give pause for further consideration being bestowed upon the comparatively small generating station, which, by reason of its characteristics, due to local circumstances, is already in the happy position of providing a cheap supply of electricity. Industrial users of electricity in Alloa have so far been fortunate; and evidence of this is to be found in the rapidly increasing output and the coming of new industries to the district. The report of the Sub-Committee on Coal Conservation is not the last word on the subject of electricity generation.

And Now there are Three.

There was great joy in electrical circles some time ago over the all-electric suburb of Glasgow which, with the "hearty support" of the Corporation Electrical Engineer, was—if we remember correctly—carried out by an enterprising builder. The "suburb," known as Hazelwood, is a comparatively diminutive affair, and the houses are classible as bungalows. Now it seems that, with the higher cost of current (to quote the writer of "Cooking and Heating Notes" in the "Electrical Times"), "*luxuries* such as electric heating in all rooms have, in *many* cases, had to give place to cheaper, if less convenient and less cleanly, methods." There is room for a long discourse here; but suffice it to say we are pleased to see the intelligent reference to "luxuries," as well as the admission that cost has in many cases risen superior to all other considerations. We do not, however, know that gas heating and cooking is less convenient and less cleanly than electrical operation; the work of applying a match is richly rewarded by B.Th.U. The prices of gas, coal, and coke have risen as well as the charge for electricity; and yet electricity has been unable to maintain its hold upon the tenants of the bungalows at Hazelwood. If electricity was so much more convenient and efficient than other heating and cooking agents—all of them having gone up in price—it would have had something with which to retain its hold upon these tenants. But it has to be acknowledged that only three houses out of twenty-four continue to depend entirely upon electricity. There is more eloquent testimony in this statement than in all else advanced by our contemporary. We know that last week caused not a few users of electric "heaters" to make inquiries as to the chances of getting gas-fires fitted. Several degrees of frost and keen winds put their electric heaters under severe test; and they were found wanting.

A Meter Dispute.

Meters, according to the belief of ordinary householders, were destined to be the seat of eternal unfairness as between supplier and consumer, and always against the latter. The consumer does not appreciate the legal status the gas-meter enjoys compared with the electric meter; and so gas and electric meters are all classified without distinction as thieves and rogues diligently working for their masters. Mr. Walter Banks, of Hampstead Garden Suburb, and the Hendon Electric Supply Company have had a little tiff over the non-registration of an electric-meter; and both, on principle, would not give way. The services of a County Court Judge and of a Divisional Court have therefore been engaged trying to effect peace, and, in both instances, the Company have lost. In the reported circumstances, we have no sympathy with them. It was a case, in our opinion, for more judicious procedure than they adopted. Mr. Banks requires for his convenience more than one electric-meter. He had one that controlled a heating apparatus. This particular one was removed, and a new one substituted. In making the substitution, the fitter forgot to remove the locking-screw of the meter—the consequence being that the meter did not register for two quarters. Payment was applied for by the Company on the basis of the corresponding quarters of the preceding year; while Mr. Banks stated that the heating apparatus was out of use during the quarters for which the payment was claimed. The County Court Judge held

that the Electric Lighting Order applying to the case provided that the dispute and the ascertainment of the amount was first to be made by an electrical inspector within the meaning of the Act. The Divisional Court confirmed the decision of the County Court Judge; but Mr. Justice Lawrence did not see why the matter could not still be determined in the manner provided, and then a cause of action would arise. At the same time, it passes our imagination how, in this case, an inspector would be able to judge whether or not current had been used; for there does not appear to be any course open to him other than to say to the consumer, "You are not telling the truth," or (to put it politely) "You are a perverter of the truth." This is an exceptional case due to an oversight (we take it) on the part of an employee of the Company; and the Company would, we think, have been better advised to take a liberal view of the matter.

CIVIL ENGINEERS' CENTENARY.

The History of the Institution.

In view of the fact that present conditions precluded more formal celebration of the event, the completion on the 2nd inst. of the hundredth year of existence of the Institution of Civil Engineers was marked by the presentation at last Tuesday's meeting—under the chairmanship of Mr. Harry E. Jones, the President—of a statement commemorative of the founding of the Institution on Jan. 2, 1818.

Beginning with a meeting held on that day, at the Kendal Coffee House, in Fleet Street—at which Mr. Henry Robinson Palmer "set forth the urgent need of a source of information or instruction for persons practising civil engineering, and pointed out in scholarly terms the advantages to be derived from recorded experience and the interchange of opinion upon questions which involve the application of scientific principles to the circumstances found in practice"—the Institution has now a hundred years of progress to its credit. Mr. Palmer's proposals were adopted, and the formation of the Institution resolved upon, "for facilitating the acquirement of knowledge necessary in the civil engineering profession, and for promoting mechanical philosophy." The original records show that there were eight founders in all, whose names were: James Ashwell, Chas. Collinge, Joshua Field, James Jones, John Thomas Lethbridge, Thomas Maudslay, William Maudslay, and Henry Robinson Palmer. These men were for the most part engaged in the construction of machinery; and "their use of the expression 'civil engineers' accorded with the distinction drawn then and subsequently between 'civilian' and 'military' engineering—a distinction that recent experience may tend to modify."

It is noted that the first paper received by the Institution was presented by Joshua Field in April, 1819; and that succeeding papers, during even the earliest period of the Institution's history, cover a range of construction and investigation almost as wide as that observed in any subsequent period. In March, 1820, accommodation was secured in a private house in Buckingham Street, Adelphi; and at that date Thomas Telford accepted an invitation to become the first President of the Institution. A Royal Charter of Incorporation was received in June, 1828; and six years later a move was made to a small house in Cannon Row, Westminster. At Christmas, 1838, the Institution entered upon the occupation of No. 25, Great George Street, which, with some alterations and additions, sufficed until 1896, when the premises were rebuilt on a larger site, to the designs of the late Mr. Charles Barry, F.R.I.B.A. Fifteen years later these premises were required by the Government in connection with their scheme of public offices; and the Institution were assisted to obtain the present more extensive site, and to erect a new building, designed by Mr. James Miller, A.R.S.A., in 1913.

The 204 volumes of proceedings contain most of the 4239 papers which have been presented to the Institution, as well as numerous addresses, lectures, and reports of researches and inquiries made by Committees formed for such purposes. This literature covers the entire field of British engineering practice, and includes in the reports of the debates the considered opinions of experienced engineers upon a multitude of problems presented by the new conditions encountered in the undertakings and investigations described. The publications have kept substantially the style adopted in 1837, having passed through the hands of only three Editors—Mr. Charles Manby, who became Secretary in 1839, Mr. James Forrest, who succeeded him in 1860 and held the office until 1896, and the present Secretary (Dr. J. H. T. Tudsbery). Supplementary to the work of recording, discussing, and investigating matters bearing on engineering practice, it has been the care of the Institution to form a reference library containing all literature relating to the profession, and deemed as worthy of permanent retention. This library, which has developed from a bequest of Telford's private library, is in its particular character unrivalled in completeness, and is unique in its possession of original reports and other documents relating to the work of early masters of the engineering profession.

The first trace of action in the direction of education and training is found in the establishment in 1838 of a class of graduates; but it was not until a quarter-of-a-century later that the interest of the Institution in the training of engineers took a very practical shape. A large part of the Presidential Address of Sir John Fowler in 1866 was devoted to the question of the best preparation for engineering pupils; and the following year witnessed the organization of the students, when the foundations were laid of the plan of preparation and training for the engineering profession which it has been the privilege of the Institution to originate and to encourage. The creation of the student class was contemporaneous with the extinction of the class of graduates. In 1897, the Institution found it desirable to establish their own examinations, both in general and scientific education. This step was taken, after conference with persons experienced in educational matters, under the presidency of Sir John Wolfe Barry, who has remained Chairman of the Examination Committee for some twenty years. The scheme of examination was designed to test suitable preliminary education, and, based on this, competent knowledge of those branches of science which are applied to engineering practice. This, however, concerns only part of the equipment of a young engineer; and the question of his practical training, which has always been required by the bye-laws, and was systematized somewhat precisely in 1910, still remains a matter of judgment on the information furnished to the Council. The position thus reached has been influenced largely by the results of an exhaustive inquiry into the education and training of all classes of engineers undertaken in 1903 by a Committee which included representatives of the leading professional Institutions and some important Universities, under the chairmanship of the late Sir William White, by a conference of engineers on the subject held at the Institution in 1911, and by the report of a Committee on the Practical Training of Engineers, presided over by Dr. W. C. Unwin, in 1914. It is proposed shortly to amplify the tests for associate membership by an examination in some particulars of practical knowledge which are thought to be inadequately proved by the present method of certificates.

As regards numbers, the early records are incomplete; but in 1828 (when the Charter was granted) there were 156 members, and in 1836 (when the "Transactions" were first published) the number was 238. Fifty years later the number had increased to 5100, and by 1914 had become 9266. At this point, the outbreak of the war—in which more than 2700 of the members and students have already engaged in naval or military service, and 246 have given their lives—checked the increase of the roll, though it has not arrested the activities, or, it is believed, diminished the prestige of the Institution.

Increased Prices of Gas in France.

The Agence Fournier, as reported in the "Journal des Usines à Gaz," states that at the end of 1917 there were 640 towns in France which have accepted the increases in the price of gas resulting from the continued prosecution of the war. Of these, 55 have come within this category during the past year. Among these latter, 10 have adopted a sliding-scale, according to which an increase of 2¾d. per 1000 c.ft. is made for every rise of 3 fr. (2s. 6d.) in the price of coal. Other instances where new contractual arrangements have led to increased prices to consumers include a considerable number of towns. Among these are the following—the figures after each signifying the price per 1000 c.ft.: Nancy and Lyons, 5s.; Nantes, 5s. 8d.; Montargis, 6s. 7d.; Libourne, 9s. 9d.; Arcis-sur-Aube, 15s. 10d.; Tinchebray, 11s. 4d.; Orleans, 6s. 1½d.; Pont l'Eveque, 16s. 10d. On the other hand, 47 municipalities who would have compounded before 1917, have accepted increases of price during last year. Among those who have done so on the basis of a sliding-scale are: Le Croisic and Cabourg, 13s. 7d.; Giromagny and Vimoutiers, 12s. 11d.; Ancenis and Caudebec, 10s. 2½d. Lastly, 21 towns have agreed to further increases—*e.g.*, Ambérieu, from 6s. 9d. to 7s. 11d.; Murat, from 5s. 5d. to 9s.; Mantes, from 7s. 3d. to 11s. 4d. It is to be specially remarked that municipal gas undertakings which before the war supplied gas to the consumer at a price close to the works' cost, as the result of a policy of dispensing with profits, have introduced very greatly enhanced prices—*e.g.*, Coulommiers, 18s.; Nangis, 17s.; Nogent-le-Rotreu, 13s. 7d.; Nemours, 11s. 4d.; Pontoise, 9s.

Effects of Solvents on Tars in "Free Carbon" Determination.—Discussing in the "Journal of Industrial and Engineering Chemistry" some effects of certain solvents on tars in the "free carbon" determination, Messrs. G. S. Monroe and H. J. Broderson say that if the selection of a solvent which when added to tar will not give rise to chemical reactions is the proper criterion in devising a method for the determination of "free carbon," benzene, toluene, and carbon bisulphide should be selected in preference to chloroform.

Supplies of Gas Coke in the Metropolitan Area.—Owing to the presence of large stocks of gas coke at London gas-works, the Controller of Coal Mines has agreed that any consumer who has already put in some form of requisition for coal or coke under the Household Coal Distribution Order, 1917, may purchase in addition, either directly or through his coal merchant, a supply of coke not exceeding 5 tons, provided that arrangements can be made for delivery before Feb. 1. This supply of coke is additional to any quantity included in the allowance under the requisition, and must be gas coke manufactured within the Metropolitan Coal Area.

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Leeds Gas-Works
Manchester Gas-Works.
Croydon Gas-Works.
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Fulham Works.
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GAS-DRIVEN MOTOR VEHICLES.

New Board of Trade Order.

IMPORTANT provisions are contained in the new Order issued by the Board of Trade, consolidating and amending the present Motor Spirit Restriction Orders, and controlling the use of gas for driving motor vehicles. So far as private motor-cars are concerned, no substantial change is made as to their use; but points on which some doubt was found to exist have been cleared up.

The use of gas for driving motor vehicles is now made subject to the same restrictions, as regards the purposes for which it may be employed, as the use of motor spirit. Subject, however, to such restrictions, gas may be used for driving motor vehicles without a permit for one month from the date of the Order, pending the issue of permits, after which date no form of gas may be used for the purpose without a gas permit granted by the Petrol Control Department of the Board of Trade. Gas permits will not give the holder a right to a supply of gas; but where it is available there is at present no intention to limit by licence the quantity that may be purchased.

Owners of private motor-cars, omnibuses, cabs, and hire cars who are at present using gas will, as far as possible, be granted permits which will enable them to employ their cars for the purposes permitted by the Order. Permits will only be granted to owners of cars which are not already fitted with gas apparatus under the same circumstances as determine the issue of motor spirit licences. In no case will both a gas permit and a motor spirit licence be granted in respect of the same car.

Owners of trade vehicles may obtain gas permits for purposes for which motor spirit licences would otherwise have been allotted; but a gas permit and a motor spirit licence will not be granted for the same vehicle, subject to this exception—that for every trade vehicle holding a gas permit a licence for the purchase of a small quantity of motor spirit will be granted for emergency purposes, varying in amount according to the size and power of the vehicle, but in no case exceeding 4 gallons a month.

Circumstances may at any time arise which will make it necessary that in those areas where gas is plentiful and easily available it shall be substituted for petrol for driving motor vehicles; and due regard will be had to this contingency in regulating and adjusting the issue of petrol licences and gas permits.

The Order may be cited as the Motor Spirit (Consolidation) and Gas Restriction Order, 1918, and took effect as from the 10th inst.

FLUELESS GAS RADIATORS.

[Communicated.]

THE writer perused with interest the notes published in the "JOURNAL" for Dec. 25, p. 604, in which were dealt with the remarks made by a London Coroner in his annual report, in so far as these were abstracted in the "Daily Chronicle," and from that source into the "Electrical Review." In the "JOURNAL" for the 1st inst. there was a more full communication by Dr. Waldo; and it is surprising that any public official purporting to be a scientific man should publish such unscientific statements, *ex parte* reasoning, and inconsequent conclusions. While these remarks apply mainly to Dr. Waldo's communication, they are also applicable to the report he attaches, signed by Dr. Hurtley.

Dr. Waldo said he is sure everyone will agree with him that a stop should be put to the continued use of flueless gas radiators; and he went on to state he is told at the Home Office that these are not allowed in factories and workshops, under the regulations of the Factory and Workshop Act. Dr. Waldo did not need to go to the Home Office to get incorrect information; he could have learned what the Act does say by consulting a copy of it. The Act merely states that the means of heating used must be such as not to interfere with the purity of the atmosphere in the workshop. Frequent communications have for many years past been made to the Home Office over this particular matter; and air samples taken in many workshops where gas radiators were being used have been analyzed, and in no case where the continued use of these appliances has been recommended have the Home Office ever challenged this.

All who have carefully considered the matter have maintained that no flueless gas radiator ought to be installed in any apartment where the ventilation provisions are not adequate to the largest possible number of occupants. That the results of the use of such apparatus in Dr. Waldo's court should have been so objectionable is a clear indication either that the ventilating arrangements were inadequate, or that the building was not one for which gas-radiator heating was suited. One would *primâ facie* have regarded a coroner's court, with its liability to frequent overcrowding, as one of the most unsuitable places for heating by flueless gas radiators.

It is astonishing that a man like Dr. Waldo, having found gas radiators unsuited to his court room, should jump to the conclusion that they are, therefore, unsuited for any and all purposes. It is also remarkable that he and Dr. Hurtley—both men with scientific diplomas—should be ignorant of the elementary fact that the various kinds of apparatus known in this country as radiators are merely so called through custom, and give off the major portion of their heat, not by radiation but by convection. Dr Waldo states that most of the heating by the radiators should be by means of radiant heat; and Dr. Hurtley states that "the warming ought to be effected by radiant heat, as by hot-water pipes." It is indeed surprising that a Doctor of Science and a lecturer on chemistry should be under the impression that the heat given off by hot-water pipes is radiant heat. Dr. Waldo states that "carbon monoxide—a highly poisonous gas—is a product of ordinary gas combustion," and alleges that the "main essential fact" of Dr. Hurtley's report "is that it shows the presence of small quantities of carbon monoxide." One turns to Dr. Hurtley's report to verify the passage, and finds that no such statement is made. In point of fact, anyone who has seen a gas radiator alight will have observed that there is no flame contact, and the gas is burned completely to carbon dioxide. Carbon monoxide is not a product of ordinary gas combustion. The conditions under which it is formed are perfectly well recognized, and do not obtain in the case of gas radiators.

Dr. Waldo complains that the radiators "loaded the air with carbon dioxide—ten times the normal amount," while Dr. Hurtley remarks that "carbon dioxide is not in itself injurious in the amount found in the room."

Turning from the question of the effect of the radiators upon the atmosphere, one finds that in Dr. Hurtley's "complete and masterly report," as Dr. Waldo describes it, a further indictment is brought against the gas radiators—that they were inadequate to heat the Court, and this notwithstanding that "the radiators consisted of twenty-two powerful bunsen burners." The only comment to be offered in this connection is that evidently these "powerful bunsen burners" were not powerful enough, or that a greater number of them were required. There seems to be some confused impression in Dr. Hurtley's mind that British thermal units obtained in the combustion of gas are less "powerful" than British thermal units yielded by other methods of heating.

The only remaining point which seems to call for remark is that, of the three complaints by juries as to inadequate heating of his court which Dr. Waldo submits, two have reference to the failure of open coal fires to yield a sufficient temperature, and the other refers to a similar failure on the part of electric radiators. Why Dr. Waldo, in transmitting a complaint with regard to the behaviour of gas radiators in his court, should occupy four paragraphs of the space in proving that coal fires and electric radiators were failures in heating the apartment is really difficult to understand.

The communication here criticized is melancholy evidence, in the first place, that Dr. Hurtley does not apparently understand the elementary laws of heat; in the next place, that Dr. Waldo does not understand Dr. Hurtley's report; and in the third place, that he neither understands how to make statements that shall be relevant to his own argument, nor how to make logical deductions from the statements he puts forward. It is singular and unaccountable that two men—both purporting to have "the scientific mind," and one of them some judicial faculty in addition—should have thus rushed into print displaying against a particular class of heating apparatus an animus which savours much more of prejudice than of impartiality—or accuracy.

CITY AND GUILDS OF LONDON INSTITUTE.

The Work of the Last Session.

THE effect of the war on the work during the session 1916-17 of the Department of Technology of the City and Guilds of London Institute is clearly shown by the report which has just been issued. For the United Kingdom, the number of students in attendance dwindled from 55,996 in 1913-14, to 29,062; and the number of candidates presented for examination, from 23,119 to 7508. In addition to the calling-up of youths of eighteen for home defence, the remunerative employment that they can now command as soon as they have left the elementary school is no doubt rightly assumed to have rendered many disinclined to continue their attendances at evening classes in technical schools.

The report (which is signed by Mr. Morton Latham, M.A., the Chairman of the Technology Committee) states that the number of students enrolled at the beginning of the school year as attending registered classes shows decreases in the majority of subjects allied to the chief trades of the country, though in mechanical and electrical engineering they have been well maintained. Among others, notable decreases are found in "Gas Supply" and "Gas-Fitting." On the other hand, in several of the chemical subjects (including "Coal Tar Distillation") there has been an appreciable increase in the number of students in attendance. In the period covered by the report, no new names were added to the Institute's list of registered teachers of technological subjects. Examinations were held at 312 centres throughout the United Kingdom, and at two in France—at Havre and at Boulogne. A candidate was also examined on board H.M.S. "Sokoto." "Heating and Ventilating Engineering" was one of the subjects on which this time no examination was held. The total number of candidates examined in technology in the United Kingdom was exactly 1000 less than in 1916.

The percentage of candidates successful in their examination stands at 60·1; the corresponding figure for 1916 being 61·5. The reports of the examiners go to show that the standard of

the candidates was not quite so high as in the preceding year, but that there was no very marked difference. The largest single centre of examination was the Bolton Municipal Technical School, from which 179 candidates were presented, of whom 134 were successful. No change is contemplated in the system of the examinations, of the Institute, which will be continued on the same lines as heretofore. Owing to the difficulty in obtaining copper, the issue of the bronze medals has had to be postponed till such time as it may be possible to secure the necessary metal.

In their reports, the examiners again call attention to the weakness of candidates in spelling, punctuation, and the writing of grammatical English. In connection with the "Gas-Fitting" examination, it is remarked: "English and spelling require more careful study on the part of the candidates, to make their meaning intelligible." Elsewhere, it is stated, there are instances where the writer has written sheer nonsense, through forgetting how a sentence began while writing the latter part of it, and not reading it through to see if the two parts were consistent. More than one remark on the length of the answers; and teachers are advised that they would do well to give their students practice in conciseness. On the other hand, in the matter of sketching apparatus and making diagrams, the examiner in "Coal Tar Distillation" says that much more care has evidently been bestowed on this part of the teaching, with good results. The report concludes: "The present time marks an important transition period in the history of technical education. The transition is that from voluntary attendance at evening classes to compulsory attendance in the daytime at continuation schools, as outlined in the Government Education Bill introduced in August, 1917. A closer relation between school and factory is to be hoped for, that the theoretical study in the one and the practical work in the other may be associated together. In the meantime, we may be confident that all employers who are in sympathy with the better technical training of artisans, and who realize how much it means to the future of the country, will assist the cause by encouraging employees to attend classes and granting them facilities to do so."

At the different centres, there were 155 students in "Gas Engineering" (compared with 147 in 1916). Of these, 90 presented themselves for examination, and there were 77 passes; the percentage of failures being 14·4. In "Gas Supply," there were 209 students (against 320); and of these 72 were examined, and 43 passed—showing a percentage of failures of 40·2. There were 244 students in "Gas-Fitting" (compared with 417), of whom 88 presented themselves for examination; there being 56 passes, and a percentage of failures in the different grades varying from 14·2 to 61·5. In "Coal Tar Distillation," 34 candidates were examined, and 25 passed; while in "Coal Tar Colouring Matters," 6 were examined, and 3 passed. In the Final examination in "Gas Engineering," 13 passed in the first class, 12 in the second, and 7 failed; while in the grade below, the passes were 21 and 31, and the failures 6. In the final examination in "Gas Supply," 9 candidates passed in the first class, 9 in the second class, and 6 failed; while in the grade below the passes were 12 and 13, and the failures 23. With regard to "Gas-Fitting," the figures were: Grade I., passes 45, failures 23; Grade II., passes 5, failures 8; Final, passes 6, failure 1. The Acting Examiners for the year were: "Gas Engineering," Mr. Samuel Glover; "Gas Supply," Mr. Walter Hole; "Gas-Fitting," Mr. Harry Kendrick and Mr. Ralph Halkett.

It may be mentioned that the programme for the 1917-18 session (which contains full information for intending students and candidates for examinations) was noticed in the "JOURNAL" for Aug. 14 last, p. 274.

Control of Nitrate of Soda.—In accordance with decisions reached at the Inter-Allied Conference held in Paris last November, a Nitrate of Soda Executive has been formed to deal with the purchase and supply of nitrate of soda in Chili for the British, French, Italian, and United States Governments. The Executive will have its offices at Empire House, Kingsway. Sir Edmund Wyldbore Smith has been appointed Chairman, and Major Paul Stomm as Secretary. Questions concerned with the purchase, sale, and shipment of nitrate of soda, the supply of fuel, bags, machinery, &c., should be addressed to the Secretary.

Getting the Best Value from Distribution Plant.—The importance of a high distribution pressure, regarded as a means of increasing the returns on an investment in gas mains and services, was emphasized by Mr. J. S. Connelly, in a paper he submitted to the Texas Gas Association. Cast-iron socket pipes had been chiefly used for the distribution of manufactured gases, not as being the best, but simply because engineers were used to them; and for a similar reason, the natural gas companies favoured a wrought-iron screwed pipe. Plain-end couplings were an improvement on the screwed joint for high pressures; but, in their turn, they had been displaced by the autogenous welded joint, which took the lead under any conditions of supply pressure. Practice proved that a high initial pressure, with service-regulators to reduce to 4 oz. at the meter-inlet, increased the delivering capacity and the return on a given outlay. Another advantage was that even a moderate pressure dried the gas, by precipitating all moisture present in it—thus avoiding the troubles caused by condensation of liquids in various parts of the distribution system. High-pressure storage was not indispensable, as a rotary booster that could be set to maintain any desired pressure up to 10 lbs., regardless of variation in consumption, was on the market.

SPONTANEOUS HEATING OF COAL.

An Investigation by Professor Knox, of Treforest.

The Principal of the South Wales and Monmouthshire School of Mines—Professor George Knox, F.G.S., M.I.M.E.—has been good enough to sanction the publication in the "JOURNAL" of the following report on the "Spontaneous Heating of Slack Heaps' which was recently prepared by him.

Owing to the difficulty experienced at the present time in the South Wales and Monmouthshire coalfield in finding a market for small coal, large heaps of this material have had to be laid down at the collieries. As the space available in the vicinity of collieries for such accumulation is usually very limited, many of the stacks have reached considerable heights—resulting in subsequent heating and the possible spontaneous ignition of the whole stack.

Our attention at the School of Mines having been called to several instances of spontaneous heating in these heaps throughout the coalfield, in both the house coal and steam coal areas, it has been suggested that, instead of issuing a separate report to each of the various collieries concerned, it would be advisable to issue a general brief report on this matter, as a guide to others who may have to commence stacking coal in the near future.

To understand the nature of the changes which take place in the coal when stacked in heaps on the surface, it is necessary to briefly refer to the origin and composition of coal.

ORIGIN OF COAL.

Coal represents the accumulation of solar energy over immense periods of time, through the action of the sun's rays on the chlorophyll contained in plant cells—producing great forest growths, particularly in carboniferous times. The regenerative influence of the rays of the sun on chlorophyll enables the latter to absorb carbon dioxide and water vapour from the atmosphere, together with moisture and mineral salts from the roots. The interactions which follow result in the formation of starch granules and sugars, which ultimately form the food of the plant and are incorporated in the woody fibre as cellulose. This may be approximately expressed as follows:

Carbon Dioxide.		Water Vapour.			Cellulose.		Oxygen.
$6CO_2$	+	$5H_2O$	+ Sun's energy	=	$C_6H_{10}O_5$	+	$6O_2$

Although coal contains only very small quantities of slightly altered wood fibre in its composition, the relationship between vegetable matter and coal is well known, and is quite apparent from the following table:

	Carbon.	Hydrogen.	Oxygen and Nitrogen.
Wood fibre	50	6·0	44·0
Peat	60	5·8	34·2
Lignite	66	5·2	28·8
Bituminous coal	88	5·6	6·0
Anthracite	94	3·4	2·6

If the carbon is kept as a fixed quantity, the change between vegetable matter and coal is still more noticeable, although it does not necessarily follow that these substances have been in turn derived from one another:

	Carbon.	Hydrogon.	Oxygen and Nitrogen.
Wood	100	12·18	88·07
Peat	100	9·85	55·67
Lignite	100	8·37	42·42
Bituminous coal	100	6·12	21·23
Anthracite	100	4·75	5·28

PROCESS OF CHANGE.

Although the process of change from vegetable matter to coal is not yet thoroughly understood, the latest researches in this direction show that coal consists chiefly of altered leaves, small twigs, spores, and fruits, together with globules of resinous matter. A large percentage of the original vegetable matter was converted into a plastic vegetable mud, in which the fruits, spores, &c., were embedded. The change has probably taken place by a process of decay, through bacterial action, in the absence of air, subsequently assisted by a gradual increase of temperature and pressure as the vegetable matter descended under the accumulated mass of *débris* laid on top of it.

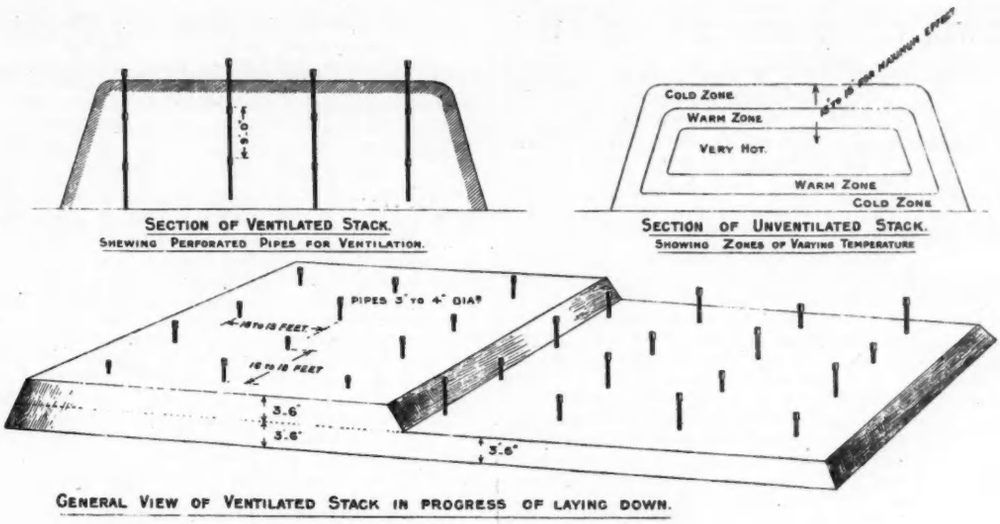
Peat and cellulose have been artificially converted into coal in eight hours at a temperature of 340° C. under 100 atmospheres pressure. At 310° C., it took sixty hours. In the conversion, the vegetable matter loses weight to the extent of 75 p.ct., which indicates that coal-seams are only a small volume of the original vegetable material from which they were derived.

Microscopical and chemical analysis shows that coals are composed chiefly of:

(*a*) Humus bodies (having high oxygen content, and carrying much hygroscopic water).
(*b*) Resinous bodies (with medium oxygen contents, but melting at 300° C.).
(*c*) Carbon (very dry).

With a varying percentage of hydrocarbons, moisture, and minera matter (ash).

Coal has the power of absorbing gases. Some coals will absorb three times their own volume of oxygen. In doing so, the absorbed gas becomes very active, and rapidly combines with the carbon and hydrogen of the resinous bodies, converting them into carbon



SECTION OF VENTILATED STACK. SHEWING PERFORATED PIPES FOR VENTILATION.

SECTION OF UNVENTILATED STACK. SHOWING ZONES OF VARYING TEMPERATURE

GENERAL VIEW OF VENTILATED STACK IN PROGRESS OF LAYING DOWN.

dioxide and moisture. This chemical action (oxidation) increases the temperature of the coal; and as the temperature increases, the process of oxidation becomes still more rapid. Coal being an excellent non-conductor, the heat thus generated in a large heap of loose coal will increase steadily, and with increasing rapidity, until the ignition point of the coal is reached.

Ignition Point.

Although the ignition point of coal is generally stated as being about 370° C. for cannel, 408° C. for bituminous, 450° C. for lignite, and 477° C. for Welsh steam coal, this will depend on the state of division of the coal. Fayol was able to get spontaneous ignition in coals at much lower temperatures, according to the fineness of the particles of the coal.

Powdered gas-making coal took fire in five hours at 100° C.; in two hours, at 150° C., in forty minutes at 200° C., and in a little over one minute at 400° C. Powdered anthracite took fire in four hours at 200° C., and in little over half-an-hour at 400° C. Though the degree of inflammability of coal cannot be directly deduced from the chemical composition, it is well known that spontaneous heating is more common in coals with a high volatile content.

This spontaneous ignition of coal in bulk has been for many years a source of great trouble in shipping. It was a noticeable fact that the larger the cargo, and the longer the voyage, the greater was the risk. It has been found that with cargoes of 500 tons of coal, cases of spontaneous combustion amounted only to 0·25 p.ct., whereas with cargoes of 2000 tons the amount is increased to 9 p.ct. It was also noted that the length of the journey was the determining factor in the number of cases of spontaneous ignition—showing that a certain time-limit is necessary to enable the oxidation to generate sufficient heat to produce spontaneous ignition.

Cases of heating in heaps of coal stored on the surface were also very common; and coking coals thus stored for long periods lose their coking properties. The heating appears to be directly related to: (1) The quantity of oxygen contained in the coal, (2) the amount of resinous bodies present. While gas-making coals and coking coals are most likely to ignite spontaneously, it is not safe to stack large masses of the driest steam coal to heights of more than 10 ft. or 12 ft., unless all the slack under 1-inch mesh has been taken out.

Storage of Coal.

Large coal free from slack may be safely stored up to a height of 20 ft. to 30 ft., but unscreened coal or slack should never be piled up in large heaps.

Slack or "through" coal containing "rashings" or other bituminous shale bands may ignite more readily than clean slack.

Washed (sized) slack does not heat so readily as unwashed slack. This is probably due to the better ventilation of the heap, and the more rapid radiation of heat through the interspaces between the even-sized pieces of coal.

Where coal has to be stacked in a limited space, it should be laid out in layers of 3 ft. to 4 ft. in height. The oxidation of the fresh raw coal in the bottom layer, and the heat resulting from it, will have been dissipated before the second layer is laid down. As coal heaps under 7 ft. in height have not been known to ignite spontaneously, the length of time the lower layers are exposed to the atmosphere before the succeeding layers are put down will enable fairly large stacks being made with comparative safety. Heaps between 9 ft. and 13 ft. thick usually show a steady rise of temperature to 60° to 70° C., then finally fall again. This, it should be noted, will render a coking coal unsuitable for coking.

Stacks of coal over 13 ft. in height are always liable to spontaneous heating if tipped in one layer. Long after heating has commenced, the exterior surface will not show the slightest change in temperature. The maximum heating usually takes place at a depth of from 13 ft. to 15 ft. from the surface. This heated area is surrounded by a zone of considerably lower temperature, which separates it from the normal temperature zone of the outside.

After about three months' heating, water vapour (steam) begins to issue from the heap. This is succeeded by the issue of a colourless gas that smells strongly of paraffin or petrol, and later smoke will appear, when the temperature of the hot zone has reached 120° to 150° C. At about 200° C., yellowish fumes are given off, and the temperature suddenly rises from 200° to 300° C., when ignition takes place.

Treatment of Heating Heaps.

Once heating has started in a slack heap over 13 ft. in depth, there are two possible methods of stopping it:

1. To exclude it from oxygen and prevent further oxidation;
2. To provide for the heat being radiated as rapidly as it is generated by oxidation.

While the former method is possible with slack heaps left in the mine, it cannot be easily accomplished where the heaps have been laid down on the surface.

To allow for rapid radiation of the heat generated under the second method the slack heap may either be reduced in height by taking away the upper layers, or ventilation pipes may be inserted at short intervals throughout the whole mass.

If the temperature has gone beyond the "steaming" stage, and there is a danger of rapid oxidation suddenly increasing the temperature to the ignition point, a number of small pits may be sunk in the mass to the region of greatest temperature, and these kept flooded with water, which will gradually filter through the mass, absorbing a large percentage of the heat. The top layer to a depth of 10 to 15 ft. should then be taken off and deposited elsewhere.

If the coal stack has been stored behind any wood barricade (or other wood structure), this greatly increases the danger of spontaneous ignition, as the ignition point of timber is much lower than that of coal. If the wood barricade is a temporary erection, it should be at once removed; but if it is a permanent structure, the coal should be immediately removed from behind it.

Prevention of Heating.

1. Wherever possible size the coal before stacking it, and put each size in a separate heap.
2. Never stack heaps of "through" coal or mixed small coals to a height of more than 13 ft.
3. If necessary (on account of lack of space) to store "through" coal or mixed smalls to a greater height than 13 ft., these should be laid down in succeeding layers of not more than 3 to 4 ft. thick. These heaps should also be provided with perforated ventilation pipes 3 to 4 in. diameter. Iron or earthenware pipes may be used—a pipe to every 300 sq. ft. of surface. The lower ends of these pipes should be at different heights from the ground throughout the stacks.
4. A thermometer should be lowered occasionally through the pipes to ascertain the temperature at various depths of the stack.
5. Never stack coal behind wood structures, on moist vegetable soils, or on ground covered by coarse vegetation, like brackens.
6. Do not mix inferior (dirty) coals with the better class varieties, and remove as far as possible all "rashings" or other friable bituminous shale bands before storing.
7. Never allow coking coals to be stored in heaps of more than 4 ft., and only for short periods, as very slight heating renders them useless for coke-making.
8. Wet small coal should not be mixed with the dry coal. It may be dumped around the edges of the stack, where the air can get to it freely.

SOME WAR TIME LESSONS FOR THE GAS INDUSTRY.

By W. NEWTON BOOTH, B.Sc.(Lond.).

[A Paper Read before the London and Southern District Junior Gas Association, Jan. 11.]

INTRODUCTION.

There is no need to remind you how the gas industry has met the call of war; of the anxieties which were felt of declining business owing to expected bad trade; and how, in spite of these fears, and of those at a later date inspired by the lighting restrictions, the majority of gas undertakings have experienced very large increases in the demand for gas; of how in spite of the growing scarcity of raw materials and the shortage of labour, the difficulties have been overcome and the demands met; of how the gas industry was called upon to provide large quantities of toluol for the manufacture of explosives, which demands were followed by similar demands for benzol and phenol for the same purpose, and for coal-tar oils for fuel; and of how these demands also have been met, and the burdens involved in meeting them cheerfully undertaken. The latest demand for coal gas as a substitute for petrol for motor vehicles is also being dealt with, and apparently satisfactorily met. Of all these, which have not been accomplished without a great deal of extra work and worry on the part of those responsible, the gas industry has just cause to be proud. But let us beware that our pride does not blind us to the fact that there is yet much more to be accomplished, and let us make certain that the industry of which we are so justly proud is, by the foresight and efforts of those engaged in it, placed in such a position that in the future it will go on from one achievement to another, becoming at each step of increasing service to the community in which we live and to mankind at large; for only in this way can it be assured of enduring prosperity.

The test of war is so severe, and the mistakes made so rapidly bring their own punishment, that the author considers it pardonable to attempt to draw an analogy between the events and operations of the war and the actions of the gas industry, and to extend, as far as may be, this analogy as a test of the probable success of, and a guide in, deciding the policy to be adopted. What lessons, then, can the gas industry learn for future guidance from the present war, and by observing which it may go on to completely fulfil its undoubtedly great sphere of usefulness. To my mind, mainly two, to which all others are, and must be, subsidiary. Firstly, success only follows due preparation; secondly, that continuing success can only be secured by sustained effort in a right and just cause. As a corollary to the latter, it seems to me essential (more so than ever at the present time) to have a very clear idea of what the cause is for which we are fighting; for only so can a strong faith be sustained, without which no success is possible.

PREPARATION NECESSARY.

Cast your minds back to the end of July, 1914. The country was in the midst of the holiday season; and lightheartedness and gaiety were the order of the day. No one foresaw that the "affair" between Austria and Serbia would consummate what was evidently a carefully-planned course of action on the part of the Central Powers, The nation was unprepared for the gigantic size of the task thus thrust upon it, with the result that our small army had to be thrown into the breach, and, along with the Belgian and French Armies, suffered all the horrors of the early months of the war. The first successes went to the side who had been carefully and methodically preparing for the preceding forty years. At the Marne, what was apparently a miracle occurred—the enemy's forward rush was stayed. It has taken all the intervening time for this country to organize its men and resources for victory; and the balance now seems more and more in our favour.

The gas industry has no right to expect that miracles will be wrought in its favour, or to count on mistakes being made which will condone its own. Its hope for future success lies in preparation continued and thorough. For what, then, should the industry be prepared? And what should be the nature of the just and right cause for which that preparation should be made? I think the answer to the first question is that we should be prepared for the difficult and exacting period which will follow the declaration of peace, and for the period of increasing prosperity which will later undoubtedly follow that. Let us bear in mind the negativing of so many of our preconceived notions which followed the outbreak of war, and form our ideas more carefully, and in the light of as much definite information as possible. The answer to the second question I have already indicated. In this case, there can be no doubt that the just and right course for the industry to pursue is to render as full, efficient, and economical service to mankind as it lies in its power to do, and that no effort should be spared to consummate this end. The watchword should be "service."

It cannot be too strongly pointed out that only so far as the gas industry can give the "best possible" service in the fullest sense of the words can it hope to continue to justify its existence in any sphere of its activities. Unification of effort and the possible superseding of the inferior of two overlapping services will undoubtedly be important questions after the war, when economy becomes a vital necessity, and when the lessons learnt in this direction during the war come to be applied to practice. It behoves us, then, to examine carefully the position, and see to it that the gas industry is prepared to offer better and more economical service in its own sphere than is offered by competing industries. In doing this, it would be well to reckon that we shall be "up against" the best possible results—not to count on the other side making mistakes, or, to use a golfing metaphor, to play always against "Bogey."

WHAT COMPETITION IS THERE TO MEET?

In the 110 years which have elapsed since the invention of gas lighting the outlook of the industry has changed tremendously. At first, lighting constituted practically the whole business, and competition was confined to candles and oil-lamps; while the various bye-products, now forming such an important source of revenue, were looked upon as a nuisance to be got rid of as cheaply as possible. Gradually the importance of the coke, tar, and ammonia residuals were more fully recognized; then the heating value of the gas was applied in cooking and heating stoves, and, later, in incandescent lighting burners and in industrial furnaces, until at the present time the calorific power of gas is held to be a more important measure of its value than its illuminating power; while the many other chemical products produced in the destructive distillation of coal are now being recovered and utilized to such an extent that every gas-works of any magnitude has its chemical plant on a more or less extensive scale.

And what of the future? Mr. H. E. Jones, in his presidential address to the Institution of Civil Engineers, summarized the present activities of the statutory undertakings of the gas industry in this country by saying that they carbonize annually 19 million tons of coal, produce 206,500 million cubic feet of gas, and supply about 7 million consumers, and that the capital employed in this work totals £140,000,000 sterling. The gas industry is thus a very large consumer of coal—one of our great national assets; and the nation has therefore every right to insist that only the best and most economical methods of utilizing this material are practised. The Fuel Research Committee is at present engaged on the work of investigating the merits of such methods, and we may await its findings with every confidence that, with their guidance, the industry will continue to expand and prosper until the majority of the total coal used is treated by some process of destructive distillation, and the valuable bye-products recovered before the gas and carbonaceous residue are consumed for the production of heat. The problem of the future then, for the gas industry is inseparably tied up with that of the conservation of coal supplies, and its activities should extend far beyond the present scope of supplying a gaseous fuel in small quantities to a very great number of consumers largely for purely domestic purposes. We should aim at also including among our customers those requiring to develop heat on a large scale and for all purposes. The problem, then, is how best to produce and distribute light, heat, and power from coal without destroying the valuable organic compounds which it is possible to produce at the same time.

What competitors are there to be met in doing this? And how are they superior to, or weaker than, ourselves at the present time? For lighting, as you all know, the only serious competitor is electricity; and its position is a strong one. At the present time the best practical form of electric lighting is the "half-watt" lamp, in which, by filling the bulb with nitrogen under pressure, it has been possible to take advantage of the higher illuminating efficiency obtained by working the filament at a higher temperature than formerly; and an efficiency of one candle per 0·6 watt is now quite usual. This means that 1000 c.p. hours can be obtained for 0·6 B.T.U., costing, at present rates of from 4d. to 6d. per unit, 2·4d. to 3·6d.—equivalent to about 1·8 lbs. to 2·5 lbs. of coal at the generating station, according to the efficiency of the station. I need not remind you that, under present conditions, no bye-products are obtained from this coal.

The advantages of electric lighting are its greater convenience and cleanliness. Freedom from fire risk and more artistic fittings are also claimed as advantages; but this is hardly borne out by experience. The great defects of all high-temperature filament lighting are the large proportion of ultra-violet rays in the light produced, and the high intrinsic brilliance of the filament. These can only be overcome by the use of special absorbing glasses, with consequent diminution of efficiency.

What is the prospect of improvement in electric lighting? It lies chiefly in the reduction in cost of electricity, due to more efficient production of power, to which the gas industry will probably largely contribute in the future. As far as the lamps themselves are concerned, the hope of greater efficiencies lies in the increase of filament temperatures; and this can only be attained either by the discovery of some new material or by increase of pressure in the bulbs to prevent volatilization. So far as can be seen at present, the increased efficiency to be hoped for will be trifling compared with the saving due to the reduction possible in the cost of electric energy.

For heating, the competitors are coal and electricity. The use of raw coal has the advantage that it is handy and easy of application, the apparatus required is not costly, and it has all the attractiveness that age and custom can give. Its disadvantages in low efficiency, smoke, dirt, and the waste of valuable volatile products only need to be effectively attacked to cause the use of such wasteful methods to be gradually discontinued and replaced by better methods. Electric heating is in itself an extremely wasteful proceeding. When electricity is required in large quantities, it is invariably generated by means of dynamo electric machines

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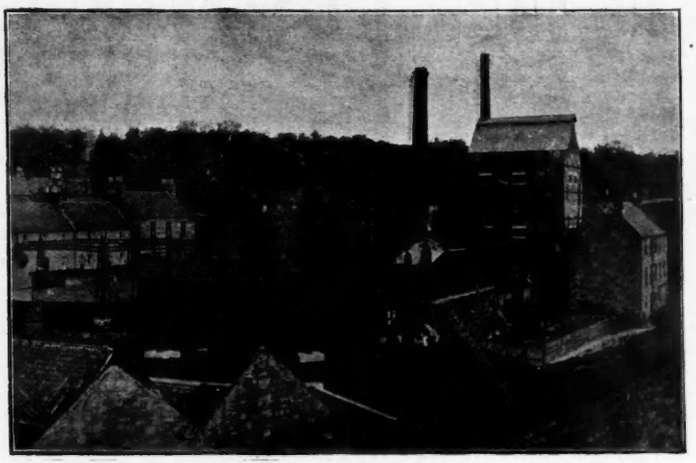

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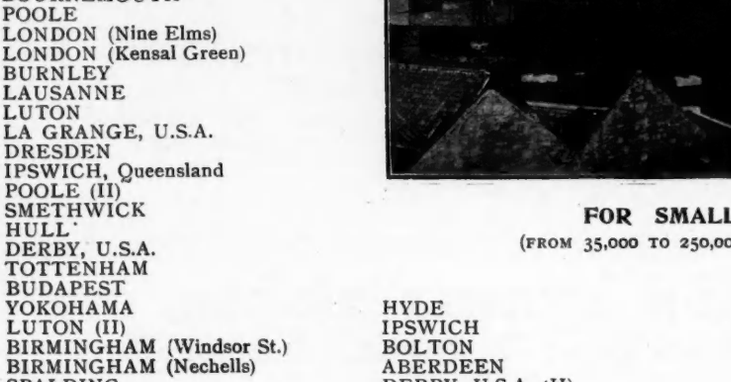

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driven, when cheap water power is not available, by heat-engines, the low thermal efficiency of which is inherent in the cycle on which they operate. It is no uncommon thing for 4 lbs. of coal to be burnt for each unit of electricity produced, even in large generating stations. Taking coal as having a calorific value of 13,000 B.Th.U. per pound, this means the expenditure of 52,000 B.Th.U. to produce one Board of Trade unit of electricity, which, when again turned into heat, can only produce 3412 B.Th.U., giving an efficiency of under 7 p.ct. The use of electricity for heating can thus only be defended when the advantages of its application—*e.g.*, for small furnaces requiring exact heat regulation, or when extremely high temperatures are required—quite outweigh the low thermal efficiency, or when the electricity is obtained from a power source that does not involve the destruction of coal.

The competitors of gas for power purposes are electricity and steam or oil or suction-gas engines. So far as the production of power is concerned, as stated above, with the exception of natural sources, such as wind and water mills, power is always generated by means of heat-engines. The produced electricity cannot therefore be truly said to be in direct competition with the gas industry for the production of power. The problem is one of the economical generation and distribution of power. In this field, gas is holding its own. In future, however, much depends on the cost at which electric power can be generated for distribution; and there is room for close co-operation between the gas and electric industries in this matter. It would manifestly be very much better for the gas industry to sell to electric generating stations large quantities of cheap gas for the production of power than to continue the supply of much smaller quantities to a large number of individual consumers, if such a course were dictated by the economic conditions.

As regards steam-engines, these are only superior to gas-engines when the power required is large—so large in fact as to be greater than the capacity of single unit gas-engines as now made; while with oil-engines the cost of fuel is very much higher than with the average town-gas engine. With regard to suction-gas engines, this again is largely a matter of size of unit. In units of over 100 H.P., suction-gas engines can generally be run for less than those operating on coal gas, unless this is supplied at a cheap rate. There are, however, certain disadvantages—such as the extra attendance required, extra wear and tear due to impurities in the gas, uncertainty at starting, &c.—which make the substitution of coal gas for suction gas an economical proposition if the price of coal gas is brought down to about 2s. per 1000 c.ft. for this purpose.

Problems to be Solved.

As the staple product of the industry is gas, it is necessary to inquire as to the various properties of a gas which constitute its value for our purposes. In order to do this, let us summarize the various methods by which gas is consumed, taking them in chronological order of importance.

Luminous Flame Lighting.—Here the gas is burnt without any previous admixture of air; and its value depends on its "illuminating power"—a property which is due to the presence in the gas of certain hydrocarbon gases and vapours which, at the temperature to which they are subjected in the flame, dissociate, giving fine particles of free carbon, which, becoming incandescent, give rise to the light. The value of the "illuminating power," even of the same gas, varies considerably with the method of burning; being very much increased by any method of increasing the temperature of the flame, such as regulating the air currents round the flame, or preheating the air supply to the burner. You are all aware of the increasing efficiency of luminous flame lighting as we pass from the old "rat-tail" or "cockspur" burners, through the cast-iron batswing, Bray's union-jet, economizer caps, Sugg governor burners, to the "London" argand, and finally to the Carpenter No. 2 "Metropolitan" argand, and of the relatively high efficiencies obtained from the Wenham and the Sugg regenerative lamps.

Heating.—For the most part gas heating burners are of the atmospheric type, depending for their action on the injector effect of a jet of gas for inducing part, or in some cases the whole, of the air supply required for its combustion, and for delivering the resulting mixture through the burner nozzles with a velocity sufficiently great to prevent the flame flashing-back. Time does not admit of the discussion here of the theory of these injectors. The amount of air which may be injected by any gas stream is affected greatly by the size and arrangement of the orifices and passages in the injector tube and burner, and depends also on the density and pressure of the gas supplied to the gas-nipple; while the amount of air required is governed by the "comburivity" of the gas—*i.e.*, the ratio of the volumes of gas and air required for complete combustion—and the velocity of the gas stream necessary to prevent "firing-back," by the composition of the gas and the degree of aëration of the gas mixture.

Incandescent Lighting.—Atmospheric burners are used exclusively for this work; and they are subject to the same laws as apply to heating burners. The efficiency of the lighting effect of a mantle varies tremendously with the temperature to which it is heated. This temperature naturally depends on the laws which govern the temperature of the flame—*i.e.*, the calorific value of the gas, the heat capacity of its products of combustion, the rate of combustion, and the size of the flame which governs the amount of heat lost by radiation, and the amount of preheat given to the gas mixture before combustion. As an example of the great effect of gas-mantle temperature upon efficiency may be mentioned the result of a test made on an ordinary bijou mantle placed upon a No. 1 "Metro" burner tube and nozzle; the temperature of the flame being artificially increased about 400° C.—*i.e.*, from an estimated temperature of 1650° C. to 2035° C. The illuminating power of the mantle rose from 45 c.p. to 131 c.p., and the efficiency from 16·30 c.p. per 100 calories per hour to 38·70 c.p. per 100 calories per hour, or equivalent to 22·17 c.p. and 52·65 c.p. per cubic foot per hour of 540 B.Th.U. gas.

Power.—The value of gas used in gas-engines for the production of power depends solely upon its calorific value, though a gas can be so rich as to give very considerable trouble in large engines, due to overheating of the piston and pre-ignition; while a gas of too low a value reduces the capacity of the engine. Any gas which is satisfactory for distribution generally would, however, be amply good enough for power production.

The valuable properties, therefore, of our gas are:

(1) *Illuminating Power.*—This is only of use in luminous flame lighting; and as this is rapidly becoming obsolete for most purposes, and the proportion of gas consumed by luminous flame burners continually decreases, the importance of maintaining the illuminating value of gas is diminishing, and the illuminating standard is being replaced by a calorific standard.

(2) *Calorific Value.*—This is important, as representing the total amount of heat that it is possible to generate by the consumption of the gas.

(3) *Calorific Intensity or Theoretical Flame Temperature.*—This is a very important property of any gas used for high temperature heating or incandescent lighting, as it is principally upon this property that the efficiency of the use of gas depends. Reference has already been made to the effect of increased flame temperature on the efficiency of an incandescent mantle. A diagram I have prepared shows the theoretical efficiencies obtainable with gases of various flame temperatures used for heating furnaces to varying temperatures. The value of the calorific intensity is obtained by dividing the calorific value (net) of a gas by the heat capacity of its products of combustion.

(4) *Comburivity.*—This is the amount of air required to give complete combustion of one volume of the gas. Variations in comburivity naturally affect the air regulation that is required for atmospheric burners.

(5) *Density.*—The density or specific gravity of a gas is important. Apart from the use of gas for filling balloons, alterations in density of gas affect the pressure drop in distribution systems, and affect the quantity of gas which will pass through a burner nipple at any given pressure, and alter the efficiency of the injector.

(6) *Pressure of Supply.*—This is not a question involving the gas itself, but is merely an engineering problem of distribution, due to main friction. It is impossible, on a system subjected to varying loads, to avoid some alterations in supply pressure, however carefully the pressure may be regulated at feeding points. The importance of such variations, however, is made relatively smaller by increasing the supply pressure; and the general tendency everywhere is towards increased pressure on the mains. On an atmospheric burner increased pressure means increased air injection; and this generally leads to higher efficiencies of heating. But varying pressures mean constant attention to burner regulation.

Two of the most important attributes of any successful service are efficiency and reliability; and it is difficult to say which is the more important. Let us take the question of efficiency first, as it is probably that on which most of the persuasive argument of our salesmen will be based. As I have attempted to show above, by far the most important gas property from the efficiency point of view is calorific intensity; and it should therefore be the aim of the gas engineer to increase the calorific intensity of his main product to the furthest possible limit. With the exception of acetylene, high calorific intensity does not necessarily accompany high calorific power; the simply produced gases, carbonic oxide and hydrogen, being superior in this respect to the richer gases.

With regard to reliability, the one lesson the war has taught in this direction is the advantage of standardization. The following is taken from the Presidential Address of Mr. W. J. Serrill to the American Illuminating Engineering Society:

> Lack of uniformity in the fuel supplied to the consumer is the first obstacle to good lighting. It is not essential that one kind of gas should be made throughout the entire country; but when the burners in any one district are adjusted to a particular variety of gas, it is highly desirable that the fuel thereafter fed to them should remain constant in quality. In the past, two qualities of gas have been general—coal gas and water gas; but in recent years coke-oven gas has become an important factor. The difference in these gases in respect of specific gravity, heating power, and air requirements make the maintenance of a desirable uniformity no easy matter. The chief difficulty has been the effort to maintain a standard candle power. This quality—now, happily, in course of abandonment—can only be maintained by varying the proportions of the mixed gases in different seasons, or by processes of enrichment. And it is these changes which cause the variations in the other qualities of gas essential for incandescent gas lighting.

The properties which it is important to standardize, each undertaking for itself, are calorific value, comburivity, density, and pressure; and for each supply district these should be maintained at a constant value between very narrow limits, in order to ensure due satisfaction to the consumer, who is not, and cannot be expected to be, an expert in the regulation of gas-burners required when

using gas of varying properties. When the consumer turns on his gas-tap, he should know exactly what he is going to get; otherwise all the advantages of an otherwise good gas supply will be dissipated by badly regulated burners.

To summarize, the problems to be solved by the gas industry, so far as the supply of its staple commodity are concerned, are (1) The increasing to the upper limit of the calorific intensity of the gas; (2) the standardization of the supply as regards density, calorific value, comburivity, and pressure of supply of the gas; and (3) cheapness, as, notwithstanding the superior efficiencies we shall be able to obtain, it will be largely on the ultimate cost of our service that we shall be judged by the consumer.*

Some Thoughts on Methods of Attack.

How is all this to be accomplished. Very largely the questions involved belong to the production of the gas. Methods of gas production have changed very much during the present century, and still greater changes—such as are foreshadowed in Mr. John West's recent paper to the Southern District Association of Gas Managers—will undoubtedly be accomplished in the near future. Something of the lessons the war has taught us in the scientific heat treatment of metals must be applied to the heat treatment of our coal; and, subject to the risks which all prophets run, I am of the opinion that the following improvements in our methods will gradually be introduced.

(1) The superior heat efficiency of the process, due to a form of internal heating of the retorts or other carbonizing chambers, coupled with a large increase in the carbonic oxide and hydrogen constituents of the gas, as also the reduction of the inert "non-combustibles," which are mere diluents and detract from the valuable calorific intensity.

(2) The more scientific heat treatment of the volatile portions of the coal with the object of procuring a larger proportion in the form of valuable organic compounds, and the increase in the recovery, in marketable form, of the combined nitrogen and sulphur of the coal. It must be remembered that the "thermal efficiency" of coal carbonization as usually practised is only about 80 p.c.; that of the volatile organic compounds comprising (say) 30 p.ct. by weight of the coal only one-sixth is recovered as such, and that more than half of this cannot reasonably be considered to be in its most valuable form; that rarely more than 28 lbs. of ammonium sulphate is recovered from each ton of coal, which only represents a nitrogen content of 0·31 p.ct. (about one-fourth) of the nitrogen in the coal; that the sulphur recovered in oxide and liquor rarely exceeds 19 lbs. per ton of coal, or about half that contained in the average coal—it will be seen that there is still considerable room for improvement in our methods.

Distribution.

With regard to distribution, this is to a large extent influenced by conditions affecting economic production. In many cases it will be much cheaper to distribute gas than the corresponding amount of coal; and I look forward to the day when gas production will tend to be concentrated in a series of large stations, and long-distance distribution of gas at high pressures to sub-distribution stations, feeding existing pipe networks, be the standard method. Before this can come to be the general practice, however, the gas industry will have to continue to displace existing coal-consuming devices by gas appliances—a policy which will tend to a much purer atmosphere in our great centres of industry, with its consequent advantages. If the problem is attacked in the right way, this should be easily accomplished, and a great saving in fuel effected at the same time.

Whatever the developments, however, it must be borne in mind that satisfaction to consumers is the prime factor; and that this can only be given if adequate pressures are maintained at points of consumption and these pressures kept at a steady value.

The Consumers' Point of View.—In dealing with consumers, both actual and prospective, it should always be borne in mind that they are not experts in the uses of gas, nor enthusiasts in its applications. From a consumer's point of view, it matters very little whether he employs gas or some other agent so long as his primary object—be it lighting, cooking, the heating of water or furnaces, or the running of his machinery—is achieved satisfactorily and cheaply; and among technically trained men, to whom the advantages of the uses of gas are commonplaces, this is often in danger of being overlooked. It is necessary to educate our consumers in the best methods of using our commodity—to see to it that reliable technical advice on the best methods to adopt is obtainable by the consumer, even in many cases to see that his appliances are used to the best advantage. One mistake that is too often made by representatives of the industry is to try and consummate a sale by making extravagant claims, often impossible of fulfilment, on behalf of gas, forgetting that the harm which will be done in such instances will far outweigh any temporary advantage which may accrue from the sale of gas for a purpose for which it is not the best agent to employ.

Sales.

This work should be undertaken by the sales department, whose salesmen, and all others in touch with consumers, should be instructed in the best methods, most recent improvements, and newest appliances which are available for the use of consumers. The activities of the sales department should extend to the tips of the mantles, and to the flues of cookers, fires, furnaces, and other heating appliances, to the running of gas-engines, and should include the maintenance (on terms) of all gas appliances coupled to its supply. [In this connection, the author quoted further from Mr. Serrill's address.*] Suitable advertising methods for the education of consumers should also form part of the policy of the sales department.

Labour.

The claims of labour must not be overlooked when making plans for the future. The Whitley report, and the recent statement of policy of the labour party, give some indication of the trend of the attitude of organized labour; of the probable future reduction in the standard hours of employment; and the claim of labour to a voice in the direction of industry. These are questions which must be faced and answered by the gas industry. The reduction in hours of labour and relief from much of the exhausting work connected with the earlier processes of gas manufacture is being gradually accomplished by the introduction of labour-saving machinery and improved plant; while a start has already been made in admitting workmen to the directorate by some of the large undertakings, notably by the South Metropolitan Gas Company. It is evident, however, that further progress in the same direction will be one of the features of the near future.

Conclusion.

In conclusion, I look forward to the future of the gas industry with every confidence that, under wise guidance, it will more than maintain its present important position among the industries of the country, and that it will play a conspicuous part in the conservation of our coal supplies, if the members of the staffs of its various undertakings continue to give it loyal and willing service.

DISCUSSION.

Mr. J. G. Clark (Gas Light and Coke Company), referring to the heat value of a Board of Trade electrical unit, said it was interesting to note the number of different figures given for this. He had gone into the matter himself, and had arrived at 3402 B.Th.U.; but in the "Gas Journal" he had seen 3420 mentioned, and elsewhere he believed, 3440. Mr. Booth in his paper had put it at 3412 B.Th.U. The author had alluded to the relation of flame temperature to calorific value. This was an important point. It was shown that, in connection with calorific values, extracting benzol and toluol meant a difference of 3, 4, or 5 p.ct., depending upon the thoroughness of the washing; but while the loss in calorific power was small, the loss in flame temperature was still smaller. Flame temperature was so important in incandescent burners, in fires, and in all cases where one produced radiation, that constituents like benzene did not matter so much as some others. Mr. Booth had mentioned the subject of mantles; and, from what he had told them, it was clear that variations in the constitution of mantles could with advantage be made when one was using flames of different temperatures. An ordinary low-pressure flame had a considerably lower flame temperature than the flame used in a high-pressure burner. He himself was convinced that this question of mantles was one of great importance; and he rather hoped Mr. Booth might have found an opportunity of making research. Somebody would have to do so sooner or later, as there was now being produced a very much hotter flame than was possible a few years ago. Standardization was a pressing matter; and it must not stop at the standardization of the gas. Appliances also must be treated in the same way. It was a painful thing before the war to see on the market so large a number of poor gas-burners. He himself collected quite a lot at one time. Most of them came from Germany; but there were one or two made in England. There was simply no design in the burner. This kind of thing they must not tolerate. They must make sure they were getting the right burner; otherwise all their work would be in vain. As to diluents, he quite agreed that it was an economic advantage to keep them as low as possible, because they tended to reduce the potential value of the constituents, and though one might have the calorific value in the gas it might not give the same result when used in the apparatus.

Mr. W. L. Westbrook (North Middlesex Gas Company) remarked that in the address of Mr. W. J. Serrill, to which allusion had been made, attention was drawn to the disadvantages of lack of uniformity in fuel supplied to consumers. He himself thought an effort should be made to secure uniformity in the gas supplied throughout the country. One of the difficulties of manufacturers was to produce an appliance that could be used on any district. Some of them would not go to the necessary trouble to modify their apparatus to suit the various gases; and this was a point of vital importance. There was no doubt that satisfying the consumer and supplying a cheap commodity were at the bottom of the whole thing; and it was absolutely impossible that this satisfaction could be given until they got constant values. At present it was out of the question to think of arriving at any sort of value at all.

Mr. D. J. Winslow (Lea Bridge Gas Company) said he was pleased to see that taking out the benzol and toluol from the gas did not reduce appreciably the calorific intensity or flame temperature. Under the heading of competition which might be expected in connection with gas, mention had been made of coal on the one hand and electricity on the other; but he had not noticed any reference to producer gas. It appeared to him (the speaker) that, as gas was used so much for furnace work, producer gas might prove a tough competitor in future.

Mr. F. Ainsworth (Ilford) asked if Mr. Booth could assist those who had to work on the district in the difficulties with which they had to contend at the present time. He remembered the time when they commenced to use blue water gas, and had to open the nipples somewhat. Now they were again experiencing a certain amount of trouble in getting the various appliances to do their work properly; and they would be pleased of any suggestion that might help them out of the difficulty. He described the steps taken at Ilford to regulate the gas and air, by which they had been able to get the gas to burn very well

* See "Journal" for Sept. 25, 1917, p. 567.

in existing burners, and pointed out that the trouble of the old burners had to be overcome, as they would still last for some time.

Mr. J. HEWETT (South Metropolitan Gas Company) said he was rather pleased to hear the author mention the difference between flame temperature and calorific value. This was a point which needed to be impressed not only on gas men, but on the general public—municipal bodies and so forth. In most cases they had got rid of the illuminating power standard; but they were asked to accept a calorific power standard. The author told them they could even deceive themselves when speaking of calorific value. They could produce a gas which was nominally of high calorific value; but it might not give the requisite flame temperature to bring about the objects for which the gas was most needed. He rather fancied the public had been led to believe that the gas which had been produced since the war was of much inferior quality to that made in pre-war times. The public had got hold of the word "stripping;" and they thought that one stripped gas as one did a person. This was one of the points that needed to be made clear. When they stripped gas, though they took from it some of the constituents which were necessary for the production of munitions of war, they were not deteriorating the quality of the gas to the extent which the public imagined. Coming to the bottom of it, the percentage of constituents which were removed from the gas was very low; and though they were of immense value for the purpose for which they were used, their absence made very little difference to the calorific value of the gas. There was another important point which there was a tendency to overlook now. They could not produce good gas unless they had good stuff to make it from. They had to pay a higher price for the rubbish they were getting; and the amouut of incombustible matter in it had increased to an alarming extent. The consequence was that, instead of 100 lbs. of coal, they only had about 80 lbs.; the remaining 20 lbs. being of no use whatever. Some movement on behalf of the gas industry as a whole ought to be set on foot—probably this was being done—to ensure the supply of a more regular quality of coal for the production of gas. They should pity the poor gas engineer, who was asked to produce a standard gas, and was given very poor material from which to make it.

Mr. G. F. COX (Commercial Gas Company) remarked that, from the figures given by the author of the calorific intensity of carbon monoxide, it seemed that water gas was to be the gas of the future, mixed with coal gas; and he would like to know what percentage of water gas Mr. Booth thought the public would stand. Would gas in future be produced by high or low temperature carbonization?

Mr. DAILEY said that of late years large central gas-producing stations in the coalfields had been spoken of; but he thought the chief thing against it was, What were they to do with the coke? How did they propose to get it to London and the other large towns? They should aim at constant constitution and constant pressure of the gas. It was very hard on manufacturers that they should be called upon to meet the differences that now existed. Everything should, as far as possible, be standardized. Reference was made in the paper to the question of labour. It seemed to him that there might be a little more intimate connection between "the powers that be" and labour—not merely manual labour, but labour of all kinds in gas-works. Every consideration should be given to the matter, in order to see what could best be done.

Mr. R. J. BEHENNA (Gas Light and Coke Company) said that, out on the district, they would like to be able to give people something more definite and correct than they could do at present. The gas was being stripped of certain constituents for a very good purpose; but when they were out on the district, they found the customers' point of view was, "What value am I getting for the money I pay, compared with what I got previously, when gas was much cheaper?" Could the author say what was the actual relative value—for instance, for heating water—of gas to-day and that supplied in pre-war times?

Mr. D. C. CROSS (Lea Bridge Gas Company) said that, with regard to what they were stripping out of the gas, and the consequent loss of value, he thought the author had "hit the nail on the head," when he said that the trouble of the gas man now was not what was being stripped out of the gas; it was what was being put in, and diluting the gas, to make up the quantity. Gas men had to do the best with the apparatus they had; for there was no likelihood of getting anything new so long as the war lasted. If they attempted to make a gas that was up to the standard composition required, all the holders would be emptied every night. They did the best they were able, and could not do more. The chief part of their trouble came from what they were putting in the gas. When they could get rid of these diluents, they would arrive at a stage which was going to help them. Several of the speakers had referred to a standard gas; but it would be very difficult to get a standard composition gas, until they had a standard apparatus. In the Lea Bridge works they had both inclined and vertical retorts; and the composition of the gas made by the two systems was totally different. With the inclined retorts, the benzol and toluol they got was quite acceptable to the Government; but the benzol and toluol from the verticals had been stated, on account of the proportion of paraffins present, to be unsuitable for munition purposes. Before they could arrive at a standard quality of gas, they must have a standard system. Steaming was going to help them very much; but only those who had verticals could take advantage of this. People who had inclined or horizontal retorts could not switch-over, and had to make what gas they could. It would be very difficult to fix a standard all over England, while everybody had a different method of carbonizing. They would have to get as near a standard as possible, and adjust the burners to the standard of the district. After the war, it would have to be the aim of everybody to send out a gas with as few diluents as possible. People went on remarking that they were receiving coal with a large percentage of ash; but they did not mind selling coke with the same percentage. In the past, washing had been done at the collieries by young men who could not be exempted; and there had been a greater number taken from the washing department than any other. This was one of the chief reasons why they were getting more ash in their coal; and he was afraid the Coal Controller could not possibly help them.

The PRESIDENT (Mr. S. B. Chandler, of the South Suburban Gas Company) remarked that they had had a very comprehensive paper, dealing with questions of vital importance to the industry just now. The gas industry had its hands very full in supplying the enormous demands for gas for munition making, hospitals, and other classes of work inherent to the war. These demands were, however, only temporary; and one could not expect them to last for very long. He believed they would experience a very general reduction in consumption on the termination of hostilities. Therefore it was absolutely essential that they should give the best possible service, and endeavour to neutralize the effect of the blow which the industry was thus bound to receive. One point which had struck him in connection with the competition of electricity for lighting and heating, it would be well for all of them to keep in mind. It was remarkable to contemplate a waste of 93 p.ct. when converting coal into electrical energy. This could not be allowed to go on. The author had mentioned an expenditure of 4 lbs. of coal per Board of Trade unit generated. This, he thought, was a little high. A standard fuel sounded Utopian; but nevertheless he believed it was bound to come. A standard calorific value, pressure, density, and so on, would go far to remove the difficulties they had to contend against on the district. No doubt it had been the experience of most gas undertakings just recently to find that consumers had applied for gas-fires, owing to the difficulty of getting coal; and it was his opinion that many of these fires, which went in as a temporary expedient, would permanently remain. This was one of the ways in which the reduction he had referred to might be made up. Another direction in which much might also be done to recover any loss of consumption after the war was by increasing the use of gas for hot-water supplies. The war had given the gas industry a great opportunity, of which it had nobly availed itself, maintaining its position in face of enormous difficulties. The future was bright and full of promise.

Mr. BOOTH, in reply, said the heating value of the Board of Trade unit could be calculated very easily from first principles; and he explained his reasons for taking it at 3412 B.Th.U. As to flame temperature and washing, if they had a good ordinary coal gas and extracted the benzol and toluol, they would reduce the heating value from 3 to 5 p.ct.; but they would get practically the same calorific intensity after as before. But the gas industry was not satisfied with stripping the gas, what they put into it reduced the calorific intensity very much. It was absolutely essential that the flame temperature of the gas—as it was being used now for high-temperature heating operations—should be kept at the highest possible figure; and anything they could do to increase it should be done. He could not give them much information as to the composition of mantles. Thorium and cerium possessed quite different qualities. The higher the temperature of the mantle, the more cerium would it stand. He believed it was quite usual to go to 1½ p.ct. of cerium for high-pressure mantles. The standardization of everything was very important; but it was an ideal state of things which seemed to be remote. The advantage they were likely to get from standardizing gas throughout the country would be very much smaller than by standardizing it in every district, and keeping it to standard. The standardization of apparatus was desirable, but not feasible for a very considerable time; and a standard system of gas making, again, raised a very difficult question, owing to the huge amount of capital sunk in the gas industry. In speaking of competitors, he purposely left out producer gas. For fairly small units of producers, coke was about the best fuel that could be used; and coke the gas industry supplied. A producer system using coal was capable of heating large installations on very much better conditions than it was possible for any undertaking to supply gas. Mr. Ainsworth had asked what could be done to get over his difficulties. The best way was to secure a standard gas. While the illuminating power standard was in force, it was absolutely impossible to put diluents into the gas; but, with a heating power standard, it could be done. The coal they were now getting did not affect the quality, but the quantity, of gas. It did, however, affect the coke. He had some fear that the coke market might be spoiled by the large amount of ash. It was very difficult to reply to Mr. Cox's questions as to what was going to be the gas of the future, and what percentage of water gas the public would stand. In America it was not unknown for water gas neat to be supplied; and he had not heard that the death-rate from carbon monoxide poisoning was very much greater there than it was here. He would not consider it an impossible proposition, with a sound distribution system, to go up to 50 or 60 p.ct. of water gas. He knew of one town in the North where it had been 45 p.ct. for months at a time in the winter; and nothing very serious had happened. As to the gas of the future, the tendency would be to increase the hydrogen and carbon monoxide content; and he thought there was a future for some such plan as passing hot water gas through the chambers in which the coal was being carbonized, as this would increase the efficiency of the system by reducing the amount of heat necessary. It would not deleteriously affect the coke to the same extent as steaming. He had been asked if large central gas manufacturing stations were installed, what would be done with the coke? The location of the stations would be decided very largely by considerations such as this. No doubt much more coke would be gasified; and in any case the carriage of the coke could very well be less than that of the coal. It would only be about 0·6 of the weight of the coal, even if present methods were continued. In regard to the labour question, the gas industry existed for one purpose—to supply gas and residuals for the benefit of the community; and it was essential, if they were to make a success of things, that masters and men should be energized with this one idea, which was now very far from being the case. Everybody connected with an undertaking must pull one way. As he had said, provided gas was only stripped, its value per cubic foot for all ordinary purposes would be reduced by from 3 to 5 p.ct. With stripping as usually practised, it was not more than 3 p.ct. For incandescent lighting, it was not as much. In fact, he should almost be prepared to say there was no reduction at all. A consumption of 4 lbs. of coal per Board of Trade unit was certainly rather high; but it was very often reached. The average was well over 3 lbs. It was possible with the best and most economical plant to produce a Board of Trade unit for a shade over 1 lb. of coal.

The author was heartily thanked for his paper on the proposition of Mr. CLARK, seconded by Mr. LLOYD, and supported by Mr. WINSLOW.

CONSTRUCTING A HOME-MADE CRUDE BENZOL RECOVERY PLANT

AT THE REDDITCH GAS-WORKS.

By C. F. W. RENDLE.

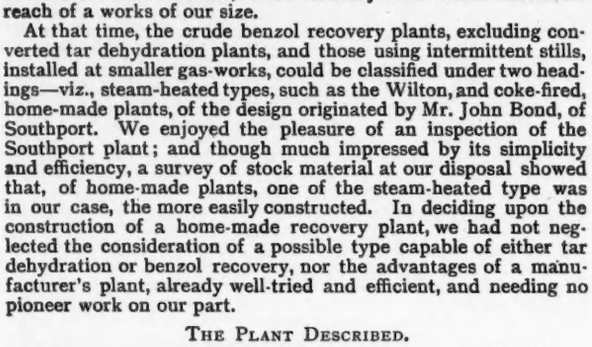
[A Paper read before the Midland Junior Gas Association, Jan. 10.]

With the advent of the "C" process for benzol and toluol extraction from coal gas, we at Redditch converted a Livesey washer into a tar-washer, and obtained results which, although of good value, were dwarfed by comparison with the figures claimed for oil-washing. Consequently, we were anxious to recover more crude benzol, if the recovery were within accessible reach of a works of our size.

At that time, the crude benzol recovery plants, excluding converted tar dehydration plants, and those using intermittent stills, installed at smaller gas-works, could be classified under two headings—viz., steam-heated types, such as the Wilton, and coke-fired, home-made plants, of the design originated by Mr. John Bond, of Southport. We enjoyed the pleasure of an inspection of the Southport plant; and though much impressed by its simplicity and efficiency, a survey of stock material at our disposal showed that, of home-made plants, one of the steam-heated type was in our case, the more easily constructed. In deciding upon the construction of a home-made recovery plant, we had not neglected the consideration of a possible type capable of either tar dehydration or benzol recovery, nor the advantages of a manufacturer's plant, already well-tried and efficient, and needing no pioneer work on our part.

THE PLANT DESCRIBED.

The design shown on the accompanying general plan having been determined upon, work was commenced on its construction; and though the progress was rendered very slow, owing to delays in the delivery of building material for the tank pits, and by the scarcity of labourers, it was eventually completed, and in its original form may be described as follows: The general arrangement is quite orthodox, consisting of the usual heat-interchanger, still, dephlegmating-column, condenser, separator, and the necessary storage-tanks, oil-cooler, and pumps.



Crude Benzol Recovery Plant at the Redditch Gas-Works.

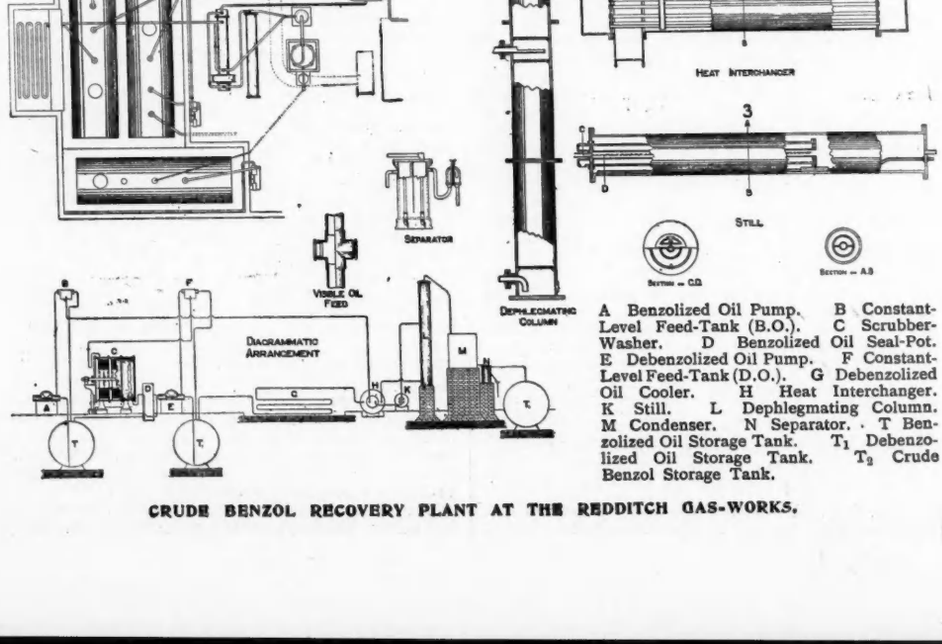
The heat-interchanger was made from a length of 16-in. diameter riveted steel tube (formerly part of our foul main), fitted at each end with a cast-iron plate, through which passed a number of 1-in. wrought-iron tubes, secured as shown in one of the accompanying detail sketches. These tubes communicated with the cast-iron caps, bolted to the ends of the outer case, and served to convey the cold benzolized oil, while the hot debenzolized oil from the base of the dephlegmating column flowed around them on its course to the cooler.

A portion of a discarded steam-heater (formerly used to heat the main gas stream entering the oxide purifiers) was used as a still; and the dephlegmating column was constructed of three lengths of flanged cast-iron pipes, 16 inches in diameter, with the necessary branches and offtakes. At intervals in the column were placed perforated cast-iron trays, resting on ledges in the castings; and the whole of the column, with the exception of the space for the benzolized oil inlet distributing pipe, and the steaming chamber at the base (indicated on the detail sketch), was filled with rings on the Raschig principle—some sawn from scrap wrought-iron tube, and others made from sheet-iron strip bent to shape.

The condenser was made from 2-in. bore stout lead pipe, coiled to 3 ft. diameter, fitted at the inlet and outlet with lead flanges and loose wrought-iron stiffening rings; the whole being supported in a galvanized iron tank by four cast-iron stands, with curved arms to engage with each of the coils. The separator in its original form was merely a disused governor-tank, covered by a flange, and fitted with an outlet near the top for benzol and one near the bottom for water. The storage tanks were purchased new, and built to specification—it having been found, somewhat to our surprise, that this procedure was more economical than the purchase of second-hand boiler-shells of equivalent capacity and doubtful utility.

The pumps are of the standard Evans type—of 2 in. bore by 4 in. stroke; the two oil-pumps being of the piston-valve type, and the crude spirit pump fitted with flat-faced winged valves. Two syphon-boxes of the type designed by our engineer were easily converted into constant-level feed tanks; and the material for the construction of the oil-cooler, consisting of a number of 2½-in. bore wrought-iron tubes connected by return-bends into the form of a four-tier flat coil, was found at hand in the shape of a disused condenser, formerly employed in conjunction with a Körting injector for the supply of air for oxide revivification *in situ*. This cooler is supported by wrought-iron standards in a concrete tank, through which water from our largest gasholder tank is circulated by means of a Tangye steam-pump. The compactness of the general lay-out of the assembled plant may be observed from the general plan of the whole arrangement. For an oil-washer, we utilized one half of a Holmes rotary ammonia scrubber—one of the twin type, with four compartments in each half. The modifications necessary for the conversion were easily made by removing the liquor-pipe connecting the two halves, blocking the two holes, transferring the water supply to the ammonia-washing portion, and replacing it by an oil-supply pipe. The benzolized oil offtake, in the form of a double U tube fitted with a pressure-equilibrium pipe, was taken into a covered seal-pot, improvised from a length of cast-iron pipe and a cap.

A supply of washing oil, consisting of a mixture of two-thirds creosote and one-third anthracene oil, was purchased; and the plant was started up. It was not long before necessity for a visi-



A Benzolized Oil Pump. B Constant-Level Feed-Tank (B.O.). C Scrubber-Washer. D Benzolized Oil Seal-Pot. E Debenzolized Oil Pump. F Constant-Level Feed-Tank (D.O.). G Debenzolized Oil Cooler. H Heat Interchanger. K Still. L Dephlegmating Column. M Condenser. N Separator. T Benzolized Oil Storage Tank. T_1 Debenzolized Oil Storage Tank. T_2 Crude Benzol Storage Tank.

CRUDE BENZOL RECOVERY PLANT AT THE REDDITCH GAS-WORKS.

bility of the oil-flow became evident; and accordingly a number of sight-feed arrangements of the simple design shown in detail in one of the accompanying sketches were placed in various positions—notably on each of the overflow pipes from the constant-level feed tanks, on the washer offtake, and at the outlet of the cooler. The temperature at the outlet of the still was easily and constantly maintained at from 120° to 130° C.; but the stream of crude spirit and water at the separator seemed altogether too small. We were at a loss to account for this, having paid strict attention to the soundness of all the joints involved, the cleanliness of the scrubber, the rate of oil supply, and other items with a possible bearing upon the matter. It was not until the condenser was dismantled, and a piece of cotton-waste removed from the outlet of the coil, that we were able to observe and recover the full make of crude benzol. Matters were, however, not for long uneventful; and our attention was next directed to the heat interchanger, where serious fractures of the cast-iron end-plates occurred, causing the incoming benzolized oil to short-circuit directly to the cooler, thereby shunting the plant. These fractures were obviously caused by the unequal expansion of the outer shell and the internal tubes, though the cast-iron plates were originally considered strong enough to withstand this strain. A disused expansion-box from an old foul main was requisitioned, and was inserted between the cast-iron outlet cap and the steel shell, as shown in the sketches. Thick steel plates were substituted for the broken cast-iron discs, and the whole bolted-up and put into successful commission again. At this period, considerable annoyance was caused by the presence of air or vapour "locks" in various portions of the plant. The still, owing to a feature of its construction, was the worst offender in this matter; the chamber formed by the oil-inlet branch becoming filled with vapour, which rose in pressure sufficiently to impede, and sometimes stop, the flow of oil. Vent cocks were placed at this and other points likely to give relief, and ensured a satisfactory and continuous oil flow.

Overcoming Difficulties.

Our procedure in operating the plant was to maintain a constant level of washing-oil in the storage tanks by keeping equal rates of flow through the washer and the plant. Constant observations of these levels showed a steady increase in the total bulk of washing-oil; and the increase became alarming as the available storage capacity was encroached upon. Dealing with the two most obvious causes of the admission of water to the washing-oil, which by now had become a disgusting emulsion, the open-steam supply to the base of the dephlegmating column was stopped, and the first ammonia washing chamber of the Holmes washer was kept empty of water. The latter procedure was necessary, because of the considerable quantity of water which was found to be carried by the gas stream from the ammonia washing half, through the connecting mains, and into the benzol washing chambers. We, however, subsequently found an equally adequate preventive without the reduction of the ammonia washing capacity, by refilling the emptied chamber, and removing the bulk of the water carried over with the gas-stream by means of syphon tubes fitted to the underside of each connecting main.

A further influence in the formation of the emulsion was rendered evident when the still steam coils, which, probably, had been gradually worn through in a hundred pin-holes, finally burst altogether. New coils of stout steel tube were fitted; and in a few days of most successful working the whole of the water content was expelled from the emulsified washing-oil—an event which was heralded by the bursting of the new coils. In passing, mention may, perhaps, be made of the fact that during the distillation of the emulsion, considerable volumes of sulphuretted hydrogen were constantly expelled, carrying with it a quantity of benzol and water in the form of a fountain from the separator vent-pipe. We attempted to overcome this trouble by sealing the off-take pipe from the condenser in the benzol contained in the separator, but without success. The crude benzol and water simply piled up in the condenser coils; and when sufficient head had been attained, the whole volume came through too violently for the benzol and water off-take pipes to deal with. The most effective remedy appeared to be to take the condensed liquid into the separator through an unsealed pipe fitted with a baffled vent. The design of the separator was, at the same sime, considerably improved, and its functioning rendered automatic and independent of the correct adjustment of the two off-take cocks, which had been an undesirable feature of the former arrangement.

To return to the still difficulty. It appeared to be unwise to rely upon wrought-iron or steel for the construction of a steam-heater, and so a simple form of cast-iron still was made. This comprised the original outer cast-iron pipe, fitted inside with an 8-in. diameter cast-iron pipe blanked at its inner end, through which steam was passed. This arrangement proved to be incapable of maintaining the oil at a temperature of more than 70° C. at the desired rate of flow. Our next attempt was to fit two fins to the 8-in. steam-heated pipe, to aim at diverting the oil flow, and causing it to make a double travel through the still. This arrangement (illustrated as Still No. 2), though obtaining a decided increase in efficiency, was a failure, owing to the fins, originally a loose fit in the outer shell, expanding and bursting the still casting. A new outer cast-iron pipe was obtained, and was fitted with the inner 8-in. pipe as in the former arrangement; but the function of each was reversed—the inner pipe serving to convey the oil, while the outer case formed the steam-bath. It was impossible, however, to obtain sufficient temperature with this design.

A still of the design shown as No. 3 was then made; the object of the modifications being to obtain a greater heating surface. The oil was taken through the annular space between the inner tube (fitted with fins to ensure a double travel of the oil) and the surrounding pipe. Steam was admitted through the inner tube into the outer shell, as shown. While eminently successful in giving the desired temperature, this still proved a bugbear in the matter of joints; the complicated joint at the one end baffling our repeated attempts to make it sound. Finally, the flange of the inner steam tube was fractured, owing to irregular expansion; and in its subsequent capacity this tube conveyed no steam, but merely served as a deflector for the oil, causing the latter to make a double travel of the heater before leaving for the dephlegmating column. This amended form was quite a success in practice; but with the second formation of emulsion in the washing-oil, it was found to be incapable of keeping the outlet-oil temperature at more than 100° C. Consequently, a secondary heater, of the design shown as No. 4, was made, to utilize some of the heat of the exhaust steam from the still proper—an object which it successfully achieved.

The second formation of emulsion in the washing-oil, to which reference has just been made, was the outcome of the removal of the inverted bend forming the debenzolized oil off-take at the base of the dephlegmating column. At one time, soon after the plant was first started, this bend was erroneously supposed to be the cause of a vapour "lock," preventing a continuous flow of oil. Consequently, it was removed; and it is probable that steam, from the open supply to the base of the column, found its way over the surface of the oil through the off-take pipe (which, of course, is never completely filled with oil in its horizontal travel), condensed in the storage-tank, and was there emulsified by the agitation from the pump suction and overflow.

A further consignment of washing-oil, of similar composition to that of the former sample, was purchased to augment our stock. This second tank-car load contained an appreciable proportion of naphthalene, which gave us considerable trouble in subsequent use. Fortunately, perhaps, the trouble was confined to the separator, where the naphthalene was deposited so freely as to oftentimes "make-up" the whole of the separator and its off-take pipe in a solid mass. The usual type of sight-feed was employed for the benzol off-take; and with its much exposed glass dome, and its tortuous course for the naphthalene saturated liquid through the swan-neck, it was probably the mechanical means of commencing the deposit. It was accordingly replaced by one of the sight-feed arrangements already described.

The pipe conveying the spirit to the storage tank was enlarged and lagged; and with the working of the condenser water at a slightly higher temperature, we were enabled to carry over the naphthalene in suspension in the crude benzol right through to the storage tank. This completely relieved us of the frequent stoppages in working, though naturally the distillation value of the crude-benzol suffered in consequence, until the bulk of the naphthalene had been driven from the washing-oil.

The plant is now successfully at work producing 65's crude benzol at the rate of about 2 gallons per ton of coal carbonized.

Conclusion.

In conclusion, though perhaps the behaviour of this plant in its initial run was attended by more trouble than is possibly experienced with other types, we have every confidence in it; and the economy of its construction is undoubted. The adoption of steam heating enables one to dispense with an attendant; and the provision of sight-feeds in important positions, and of floats indicating oil-levels in storage tanks, renders evident the smooth (or otherwise) running of the plant at a casual inspection.

With regard to the most preferable type of still, our experience has conclusively proved that some form of coil is certainly the most efficient; and if one could rely upon a benzolized oil free from ammonia or sulphuretted hydrogen or both (and this is a plea for the benzol-washing of coal gas after oxide purification), then the design of Still No. 1 is all that could be desired. Undoubtedly, our still of this type would have done service for a longer period, if the coils had been used to convey the oil, and the steam had been admitted to the outer shell.

Again, with regard to the heat interchanger, we are confident that a coil type would be much more efficient as an economizer, and easier to construct, than the multitubular type described. In common with others who have installed recovery plants for crude benzol, we are naturally most interested to learn something of the future aspect of benzol recovery, and its relation to the smaller gas undertakings; and it is hoped that members present may have some remarks to make upon this matter.

It is to be regretted that the time of the writer has been so fully occupied in overcoming the various mechanical difficulties experienced, that no interesting data are as yet available relating to the distillation figures for the crude benzol, the saturation of the washing-oil, and the effect on the same of various rates of oil-flow through the washer.

DISCUSSION.

Mr. Rendle, in addition to reading the paper, went fully into the details of the plant; and he was afterwards asked a considerable number of questions arising out of the matters with which he had dealt.

The President (Mr. R. G. Marsh, of Birmingham), in proposing a hearty vote of thanks to the author, remarked that the paper was one which, unfortunately, he himself was unable to discuss or criticize, as the subject was one of which he had only a limited knowledge. But

there was no doubt that Mr. Rendle had given them a very interesting account of difficulties overcome in the construction of the plant; and the experience gained and ingenuity exercised were well worthy of being placed on record.

Mr. T. H. POULSON (Stafford), who seconded the vote, remarked that the author had certainly had a great many difficulties; and he (the speaker) did not think he had overcome them all. One thing he would like to know was the amount of steam required—per ton of coal, per gallon of benzol, or per gallon of crude oil. In the matter of the cost of the plant, he was not at all sure the author had secured any advantage. For instance, he had made four stills before he got a suitable one; and there had been a good many breakages. In fact, it seemed to him that the arrangement must have cost a great deal more than new plant would have done. It would be interesting to know whether the lead coil was standing all right, or whether the acid in the creosote and anthracene and the sulphuretted hydrogen had had any effect on it. One point with regard to a benzol plant about which one could not be too particular was the pumps. In his own case, they had two similar pumps to those which Mr. Rendle had mentioned. They were not made by Messrs. Evans & Sons. They had been working for about nine months, and were now replaced by a fly-wheel type of pump. The trouble with them was that the pumps were situated a long distance from the boilers—considerably over 150 yards. The pressure varied a little, and the pumps were racing away, and consequently knocking themselves to pieces. With the fly-wheel type of pump, they were getting a much more regular quantity of oil running through the plant. With regard to the sight-feed arrangement referred to, so that one could ascertain how much oil was being circulated, he was wondering whether it would be possible to use a tundish in this kind of plant—placing it sufficiently high up, and seeing the amount of oil going through directly in this way. Mr. Rendle was no doubt right in assuming that fractures were caused by the unequal expansion of the outer shell and the internal tubes, because they had had somewhat the same trouble. Expansion was really rather a big thing to consider. With reference to the statement in the paper about the steam-coils being gradually worn through in a hundred pin-holes, he might say that in his own case they had a Hird still, in which there were five tubes; and the still was gas-fired. The plant had been in operation over nine months; and they had only just noticed that oil was spotting through one of the tubes. The still had now been opened up; and in future they would do this at periods of not more than six months. As to sulphuretted hydrogen being constantly expelled, in their plant they did not get very much; and there was no necessity to have an oxide purifier. What amount of ammonia was there in the gas at the time that the author was washing? He was wondering if ammonia had any effect on the tubes. Mr. Rendle stated that one consignment of washing oil contained a very large percentage of naphthalene. At Stafford they had had no trouble in this way. No doubt they were fortunate, as the naphthalene content of their creosote was under 3 p.ct. in the new oil. He did not quite understand a remark the author had made, that he was getting 2·7 gallons of crude benzol per ton of coal carbonized when they were on straight coal gas, but now it had dropped down to 2 gallons per ton using water gas. The fair basis to take it on was not coal and water gas, but really coal alone. The question was not how much benzol one was getting for the amount of gas made, but for the quantity of coal used. He supposed it was quite right to say that the adoption of steam heating enabled one to dispense with an attendant; but in his own case, using gas, they gave the plant very little attention. The quantity of gas they were consuming was pretty high—20,000 c.ft. per 24 hours, using 100 tons of coal. Of course, with gas they had to take the amount it actually cost them, because they got all the ammonia, benzol, &c. Therefore, though the figure he had quoted might seem high, he really thought they could work more cheaply than with steam. While on the subject, he would like to protest against the present price of benzol. They were offered 9½d. per gallon of 65's; but if they bought paraffin to remedy naphthalene stoppages, they had to pay from 1s. 3d. to 1s. 5d. per gallon. The smaller gas-works which had put up these plants had done so more for patriotic reasons than anything else; and it was too bad to offer them only 9½d. per gallon.

Mr. S. J. D. WILLIAMS (Stourbridge) said that at his works they had been oil-washing for a short time. They had a tar dehydrating plant of the Wilton type, with an additional fractionating column. They utilized an old Lancashire boiler for the washer, and washed at the outlet of the purifiers. As they used their tar plant in the summer day and night, they could not very well oil-wash at the same time. Therefore they had to put up some form of debenzolizing plant; and they had at present under construction a small steam-heated one, something after the style of that which Mr. Rendle had described. The author's benzol storage tank was underground; but in his own case it was exposed. Had Mr. Rendle any arrangement for warming it, for emptying in the cold weather? One of their first difficulties was an air-lock on the benzolized oil pipe from the washer. This they got over by placing a tee on the highest point of the pipe, and arranging a small vent-tube with an open end. With regard to the benzol and water separator, this piece of apparatus ought to be fitted to all benzol plants. It did away with the human element, and was easily fitted. One great advantage of a steam-heated plant, was that it reduced the big risk of fire. They were dealing with oils that were highly inflammable; and the less light of any kind there was about, the better.

Mr. J. W. PICKERING (Birmingham) remarked that he was sorry Mr. Rhead was not present, as he would no doubt have had something to say. Mr. Rendle had told them that the plant was put down with a view to possible use for tar dehydration when it was no longer required for its present purpose. They could not say now what would be needed after the war. It might be that in normal times benzol extraction from coal gas would still be practised—at any rate, at large works. The author, in his paper, talked about constant level feed tanks. They had had some experience in this matter; and they had adopted a constant-head reservoir with variable sized jets, which seemed to work fairly well. The jets could be carefully graduated beforehand. They had had trouble in Birmingham with naphthalene; and they used paraffin on the inlet to the station-meters.

Mr. RENDLE, after acknowledging the vote of thanks, said, with regard to the several queries by Mr. Poulson, he was unable to give the actual figure for the steam consumption of the plant, in pounds of steam per gallon of benzol recovered; but he could assure him that it was extremely small. Full boiler pressure was maintained in the still; and the outlet-valve was only just eased from its seating, thus passing very little steam. The pumps were so small as to require an almost negligible consumption to drive them at the requisite speed. He had reason to believe that the cost of the total steam used would compare very favourably indeed with that for the quantity of gas required by a gas-fired plant of like capacity. Though four types of still were tried before they met with continued success, this necessity was entirely attributable to the presence of ammoniacal liquor in the washing-oil, and its destructive action upon the material of the still, and not at all owing to faulty design or failure of the apparatus in its intended capacity. The stills were not expensive; and the cost of the whole plant was certainly much lower than that of a manufacturer's plant of similar capacity, and if built on the same site. The lead-coil condenser had given no trouble, and showed no signs of corrosion; and they had nothing but praise for the behaviour of the fly-wheel pumps. The ammonia in the washing-oil emulsion came from the contained ammoniacal liquor, and not from the gas in the benzol-washer, as suggested by Mr. Poulson. With reference to the reduction of the benzol extraction figure when water gas was mixed, this result was partly owing to the impaired washing efficiency of the scrubber, because of the presence in bulk of a diluent gas; and, again, owing to the fact that the one-half of the scrubber alone was barely capable of dealing efficiently with the gas stream. Moreover, at this period about 30 p.ct. of poor stock coal was being used. In reply to Mr. Williams, the warming of the crude-benzol storage tank, to which he referred, had been unnecessary as yet. No derangement of the working of the plant had been experienced as a result of the change in viscosity of the washing oil in conjunction with the use of constant-level feed tanks. Undoubtedly, this was a possible outcome of the use of such tanks; but, in his opinion, the variation in the speed of pumps was much the greater evil.

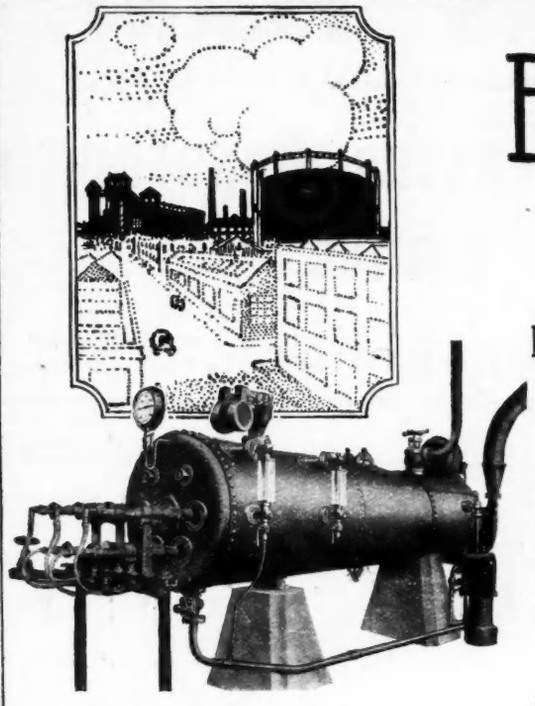
Mr. Adam's Article: A Correction.—In the article that appeared last week from the pen of Mr. W. Gordon Adam, B.A., a correction is needed in the third paragraph under the sub-heading, "Preliminary Distillation." It should read: By decomposing the sodium carbolate solution with dilute acid, the tar acids may be separated and valued by Lowe's method.

Coal Ash as a Refractory Material.—The use for fire-bricks of common coal ash has been suggested by the great resistance to heat of this material. It is claimed that a suitable binder has been provided in the Wagner process; and tests are being made of bricks, both as a fire-proof building material and as a furnace lining. In an oil-fuel combustion chamber, subjected to temperatures up to 3000° Fahr., they are said to have given three times the service of the old fire-bricks.

Extracting Gasolene from Natural Gas.—There is a case pending in the United States Courts, in which the question to be decided is whether motor spirit is a constituent part of natural gas. The United Natural Gas Company are seeking to restrain the Alum Rock Gas Company from extracting motor spirit from natural gas which they deliver under contract to the plaintiffs; their contention being that this spirit is a constituent part of the gas, and that in removing it the defendants are taking something which they have already sold. The argument of the defendants is that the spirit is not a part of the gas, and therefore they have the right to remove it.

Tar from Lignite.—A French firm, for the purpose of distilling lignite for tars, are constructing an improved Ziegler type of furnace similar to that used for the distillation of peat—a type yielding about 7 p.ct. of tar, which is treated by fractional distillations carried out *in vacuo*, to increase the output of heavy products. This is followed by chemical purification by washing with dilute sulphuric acid and soda. The crude paraffin, extracted by crystallization of the heaviest oils, is first passed through the filter-press. The purification consists of a series of filterings in the filter-press, and meltings in light oil. The last traces of oil are removed by scrubbing with superheated steam; and the paraffin wax is clarified by filtering through animal black.

Risks Incidental to Household Refuse Removal.—The "American Gas Engineering Journal" comments strongly on the dangerous and objectionable methods at present in use for the collection and removal of household garbage and refuse. The municipal collecting vans, with their unsavoury contents, go through miles of city streets, past children at play, stand for some minutes close to open carriages at times of traffic congestion, and all the time are close to the nostrils and eyes of numbers of individuals. The load is made up by instalments opposite each residence, from which the household bin is carried out and emptied, each addition being more or less attended by a cloud of dust, which is diffused over the neighbourhood and carried into the houses, and by the dropping of fragments, which decompose and afford a feeding ground for hundreds of disease-breeding flies. The remedy for this unwholesome condition of things is an incinerator heated by gas in every household. The handling of refuse would in that case not be attended with objections, because it would be destroyed before decomposition and offensiveness had set in. Our contemporary might also have followed up the refuse to its final destination. Possibly the use of refuse destructors is general in America; but in England the practice of having a tip on at present waste land near the outskirts of the district, but which may eventually be utilized for residential purposes, is prevalent in small towns, as saving the cost of a destructor.



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Telegraphic Address:
Inland: "Metrogas, Peck. London."
Foreign: "Metrogas, London."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Sulphate of Ammonia Selling Schemes.

SIR,—With reference to the interesting retrospect which appeared in your issue of Dec. 25, our attention has been drawn to the paragraph on p. 597, dealing with sulphate of ammonia. You there state that the equalization scheme had a very short life, and was withdrawn. This is quite correct as far as the first and more elaborate of the two schemes formulated is concerned; but we wish to point out that the second and less elaborate scheme is now in force, and considerable dividends have already been paid to makers.

We may say that the present scheme carries out the central idea of the original scheme, which was to enable makers in agricultural districts to sell the whole of their makes for home consumption, and at the same time obtain a fair share in the higher price obtained for export.

The Government delivery scheme merely equalizes freight charges; and the Sulphate of Ammonia Association has nothing whatever to do with this.

We may say that nearly all manufacturers have signed the equalization scheme.

D. MILNE WATSON.

Sulphate of Ammonia Association,
84, *Horseferry Road, S.W., Jan.* 9, 1918.

Unequal Distribution of Coal.

SIR,—I enclose copy of a letter sent to-day to the Coal Controller, by order of my Directors, who also ask me to send you the copy.

It is reported that Worthing houses are overstocked with coal, and certainly there is no shortage of house coal coming into the town.

SIDNEY O. STEPHENSON,
Engineer & General Manager.

Worthing Gas Company, Jan. 12, 1918.

[ENCLOSURE.]

The Coal Controller,
Holborn Viaduct Hotel, London.

Dear Sir,—My Directors have this morning held a special meeting to consider the very serious position we are placed in with regard to coal. We have now only four days' stock, and have had to reduce the pressure to an extent that is causing grave inconvenience in the town. Fortunately the past two days show signs of a resumption of proper coal supplies, and we may escape disaster. My Board desire me to express their appreciation of the efforts of your Department in bringing this about; but at the same time they also desire me to lay their views on the situation generally before you.

They are of opinion that the present conditions have been largely contributed to by undue anxiety on the part of the Coal Controller to fill the coal cellars of private houses, in the execution of which scheme thousands of tons of good gas-making coal were diverted from a market which was already short in its supplies. In consequence, the anomalous position exists that coal which ought to be carbonized at the gas-works, and made to produce urgently-needed munitions of war, is being wasted in house grates; while gas-works are short of coal, and have had to reduce the manufacture of gas (and incidentally munitions); causing grave inconvenience and loss, and further are in many instances over-stocked with coke which would make good fuel for household purposes without dispersing munitions material into the air.

We were asked by the Coal Controller last summer to lay in good supplies of coal; but this was rendered impossible for two reasons: First, the shortage in the gas-coal market, aggravated by the diversion of some of it for household purposes; and secondly, the serious delays in transit on the railways—particularly to the South of England. With regard to the latter point, apparently all coal is treated on the same basis. We maintain that coal for gas munitions works should be treated preferentially. Inordinate delays of the wagons in transit make it most difficult to get supplies through, such as will permit of stocking.

My Directors wish, with all respect, to make the following suggestions:

(1) That no recognized gas-making coal be allowed to be sold for household or similar purposes.
(2) That in towns where there are good stocks of coke, the supply of household coal be curtailed till such stocks are reduced.
(3) That coal supplies for gas-works and munitions works are expedited through "urgently" on the railways, under special order.

They are of opinion that if the above suggestions are adopted, the situation would be considerably eased if not righted.—Yours, &c.,

(Signed) SIDNEY O. STEPHENSON, Engineer & General Manager.
EDWARD C. PATCHING, Deputy Chairman.

Calorimeters.

SIR,—We notice in the current issue of the "JOURNAL" a letter, signed "Light and Heat," asking for information with regard to calorimeters.

We are the manufacturers of the Beasley recording gas calorimeter; and, although your correspondent does not in his communication touch on the question of a recording instrument, we think its advantages will be obvious to him. Our recorder gives a written record of the calorific value; and the only calculations required are the ordinary corrections for temperature and barometric pressure. The attention required by the instrument when once it has been started to work is about two minutes a day, from ten to fifteen minutes once a week, and an occasional overhaul—involving three or four hours' work every few months.

W. PARKINSON & CO.

Birmingham, Jan. 10, 1918.

Corrosion of Mains in Acid Soils.

SIR,—I note on p. 67 of your issue of Jan. 8 that Mr. Beveridge says:

> "Where ground has been made up with ashes, there is the evil of subjecting the mains to an acid bath, and consequent rapid corrosion."

I would like to know if Mr. Beveridge really found such acidity in ashes.

Mr. James M'Leod, in a paper read to the Institution of Gas Engineers in 1911, said:

> "I have never met with a sample of ashes or ashpit liquor which was not strongly alkaline."

And my experiments so far bear this out.

T. ORR.

Motherwell Gas-Works, Jan. 12, 1918.

Prices of Gas Products.

SIR,—As a subscriber to the "JOURNAL," and a regular user of the prices quoted therein under the heading "Current Sales of Gas Products," I must write to say that, since the notes headed "From a Market Correspondent" have appeared, I have been struck with the differences between his figures and those given under "Tar Products in the Provinces."

My company are producers and sellers, and also buyers of tar products, and the prices given under the latter heading, according to our experience, seem much more accurate (as representing the business done) than those given by your "Market Correspondent" under the heading "Tar Products."

One would like some explanation as to why the quotations are so very different in many cases. As an instance, please see the tar prices in the "JOURNAL" for the 8th inst., which are 27s. 6d. and 31s. 6d. in one paragraph, against 25s. to 26s. Midlands, and 26s. North, in another.

In the "JOURNAL" received this morning your correspondent also makes a very inaccurate statement—viz.:

> "It would seem that the difficulties of using a fuel oil and pitch mixture have been overcome; and the demand for pitch is just about up to current output."

So far from this being the case, in Yorkshire at least, many distillers have still to stock practically all the pitch that is being produced.

Jan. 9, 1918. AP-SOL.

Gas Supply Troubles at Burnley.

One day last week there was practically no gas at Burnley, and oil-lamps and candles were in great request. Mr. J. P. Leather, the Gas Engineer, gave the following explanation: The fact is that we had absolutely no gas in the holders. We knew we should have some difficulty, but we hoped to be able to continue and avoid getting absolutely without stock. The coal we have been receiving for some time is so bad, and contains such a large amount of stones and dirt, that we have not been able to make the quality of gas we should have. This complaint of dirt in coal is general throughout the country. The National Gas Council have approached the Coal Controller on the question; and the only satisfaction they got from him was that he would investigate any particular complaint, but could not attend to a general complaint all over the country. Further, the coke produced from the coal is not good; and there is difficulty in heating retorts to the proper temperature. Then, too, we have had to supplement the coal gas by considerable quantities of water gas. The quality of the coke affects the quantity of gas that can be made in the water-gas plant. The net result is that we have at present plant and men at work that in normal times would have produced 4½ million cubic feet of gas, but we have difficulty in making 3 million cubic feet. The whole plant at the gas-works is fully occupied, and yet unable to make the quantity of gas it ought to produce. During the cold weather of this week, some of the cotton mills burned gas in the middle of the day in order to keep the places warm. A great number of the mills have compressors, which draw the gas from the mains; and they have plenty of pressure for their gas supply. The effect on Wednesday was to draw the gas off the mains and prevent other people having a sufficient supply.

Shortage of Gas at Bradford.—For a few days in the middle of last week there was a shortage of gas at Bradford, due to the heavy demand of the dark days and scarcity of labour. The usual amount stored was diminished by the action of a number of stokers in unduly prolonging the Christmas holidays. One circumstance with another, necessitated a reduction in pressure. At the same time, the intense cold of the early part of the week caused the freezing of some household water-meters, and added to the inconvenience felt.

The Halifax (Nova Scotia) Explosion.—Mr. Frank A. Hammond, an official of the Nova Scotia Tramways and Power Company, writing to his parents, gives a vivid account (which has been reproduced in the "Yorkshire Post") of the effects of the terrible explosion which occurred at Halifax in the early part of December. Referring to the gas-works, he says: Our gasholder was only slightly damaged; but the rivets on the seams of the steel plates were shorn off by the force of the concussion, and the plates parted just enough to let all the gas into the air—the holder coming down, of course, like a passenger elevator. This gasholder is at least 2 miles from the point where the explosion happened; so that you will have some idea of the force of the blast. It has been reported that the shock of the explosion was felt 300 miles out to sea.

REGISTER OF PATENTS.

Treatment of Refuse Liquors from Gas-Works. No. 111,883.

WELLINGTON, S. N., of London Wall, E.C., and ETHERTON, S. B., of Barnsley.

No. 17,698; Dec. 8, 1916.

This invention relates especially to the treatment of the refuse liquors, generally known as "devil" liquors, and waste liquors containing a considerable quantity of sulphocyanides, pyridine bases, hydrocarbons, chloride of lime, calcium sulphate, and sulphides in solution. Such refuse liquors are passed into a gas-producer for total destruction, and "incidentally form a useful contribution to the supply of fuel gas therefrom." The liquors are collected and stored within a tank made of material adapted to resist corrosion, and mounted at such an elevation that they may, under gravity, flow into a gas-producer and be converted into steam and gases. The liquors are advantageously first mixed or treated with fresh lime before use, to increase the yield of ammonia.

The refuse liquors are thus utilized and contribute to the utility of the producer, and "thus a waste product is disposed of in a useful way."

Liquid Hydrocarbons.—No. 111,933.

HEYL, G. E., of Kingsway, W.C.

No. 251; Jan. 5, 1917.

This invention relates to means for increasing the yield of lighter liquid hydrocarbons in the distillation of heavier hydrocarbon liquids, such as mineral oils, coal oils, coal-tar oils, shale oils, and the like.

The patentee says: The yield of lighter liquid hydrocarbons, on fractionally distilling a heavier hydrocarbon liquid, can be increased by impregnating the hydrocarbon liquid, before distillation, with a hydrocarbon gas or even with hydrogen without external heating, and can be still further increased by causing the absorption of the gas by the liquid to take place to a saturated degree by maintaining the temperature below that which it would acquire by the absorption process. By maintaining the heavier hydrocarbon liquid at the normal temperature during the absorption of the gas, the amount of the absorption is increased, and also the quantity of light hydrocarbon liquid which can be distilled therefrom. Moreover, both the absorption of the gas and the yield of light liquid hydrocarbon on distillation can be still further augmented by reducing the temperature of the hydrocarbon liquid during the absorption process below that of the surrounding atmosphere—such augmentation being increased with the reduction in temperature.

Carburetted Water-Gas Production.—No. 111,934.

HEYL, G. E., of Kingsway, W.C.

No. 252; Jan. 5, 1917.

This invention relates to the production of carburetted water gas free from sulphur; and its object is to enable sulphur containing oils—such as sulphur containing mineral oils, coal oils, coal-tar, and shale oils—to be used for carburetting or enriching water gas.

The water gas for the purpose is produced, in the usual way, by passing steam through a mass of incandescent coke. According to the present invention, the oils are supplied to a vapourizing chamber, and the resulting vapour is conveyed by a stream of water gas to a superheating chamber, where the vapour is cracked. "The gaseous mixture then flows through a purifier containing ferric-oxide or other sulphur-removing substance of sufficient dimensions to operate not only on the sulphur which may be derived from the coal from which the water gas was generated, but also the sulphur contained in the carburetting vapour."

Distillation and Dehydration of Coal Tar Oils and Debenzolizing of Wash and Other Oils and Liquids.—No. 111,956.

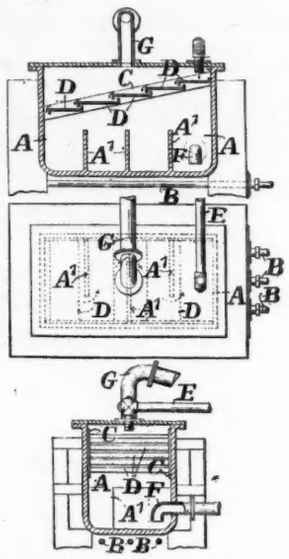
HAMMOND, T. C., and RICHARDSON, C. K., of Huddersfield.

No. 3196; March 5, 1917.

This invention has for its object the provision of means for preheating tar and other oils or liquids, comprising a series of overlapping plates arranged step fashion above the heating apparatus and baffle-plates so as to be heated by the heat from the still and forming a passage for the tar or liquids in flowing to the inlet to the still. The preheating means also performs the combined functions of a preheater and fractionater, whereby the lighter oils and water contained in the tar, &c., are vapourized, and therefore removed and collected before the tar is distilled; the preheater and fractionater also preventing the escape of the heavier oils not intended to be extracted from the tar by local heating in the still.

The illustration is a longitudinal sectional elevation of a still referred to, and a plan view and cross section.

The still A is heated by gas supplied through the bunsen burners B arranged underneath it. In the framework C at the upper end of the still are a series of plates D, arranged so that each plate from the inlet end to the discharge end overlaps a portion of an adjacent plate supported at a lower level than the preceding one. The plates are heated by the heat rising from the interior of the still; and they form a passage for the tar or oils or liquids in flowing to the inlet to the still proper. The crude tar supply in this instance is fed through a pipe E, and flows from the end of it, over the succeeding plates, to the lowermost one. It then falls into the bottom of the still at the further or inlet end, passing thence along the still between the baffle-plates A^1, and finally discharging through the pipe F.



Hammond and Richardson's Dehydrator and Debenzolizer.

The heat of the plates of the preheater suffices to drive off the lighter oils and water contained in the tar or oils as it descends in a thin stream or film over the series of plates; the vapour being carried away by a pipe G to some suitable condenser.

If, say the patentees, local heating of any part of the still, or vapour tension, causes vapourization or the carrying-off of (say) anthracene or similar oil which it is desirable to retain in the tar or oils, the vapour rising into contact with the under surfaces of the plates D condenses and falls back into the still—the plant "thus eliminating the disadvantageous results caused by local heating in the still."

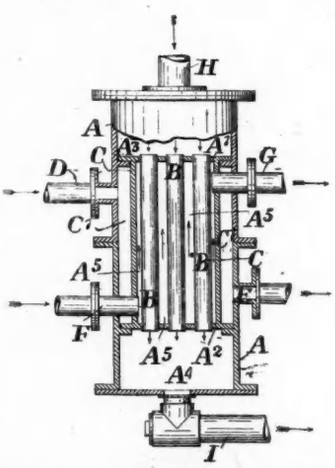
Should the temperature of the still be such as to vapourize oils not affected by the passage of the tar, &c., over the preheater, the vapours not condensed by contact with the under surfaces of the plates will pass through the spaces between each adjacent plate and enter the pipes G leading to the condenser.

Combined Condenser and Heat Interchanger. No. 111,961.

RICHARDSON, C. K., and HAMMOND, T. C., of Huddersfield.

No. 3689; March 14, 1917.

This combined condenser and heat interchanger is particularly applicable for use in conjunction with stills or in connection with other plants where condensation and interchange of heat between liquids or fluids or vapours is required.



Richardson and Hammond's Combined Condenser and Heat Exchanger.

It comprises two concentric chambers with pipes (open at each end to separate chambers) extending through the inner chamber and heated by the passage through them of vapourized oil or the like, or steam. The inner chamber is further heated by dehydrated tar or the like caused to pass through the outer chamber—the crude tar to be heated being fed to the tube chamber.

The vessel A has near the upper and lower ends horizontal partitions or walls A^1 A^2, which receive the ends of a series of tubes or pipes B, extending between the two partitions and open at their ends to cham-

bers A^3 A^4. Extending between the partitions, and surrounding the tubes in a chamber A^5, is a wall or shell C, which forms an annular chamber or space C^1, intermediate of the outer wall or shell of the vessel and the chamber A^2. The chamber C^1 is provided with an inlet pipe D and an outlet pipe E on opposite sides, and it also has an inlet pipe F and an outlet pipe G, on opposite sides of the vessel.

If the interchanger is employed in conjunction with (say) a tar distillation or dehydration plant, the treated tar is led through the pipe D into the annular space or chamber C^1, and passes out through the pipe E. The crude tar or liquid to be heated is fed through the pipe F into the lower end of the chamber A^5, and vapourized oil or the like (or steam) is admitted through the pipe H into the chamber A^3, where it enters the pipes B and, passing down, escapes into the chamber A^4, whence the distillate escapes through the pipe I into a receiver.

The crude oil or other liquid admitted to the chamber A^5 is gradually warmed as it rises up between the tubes by the heat radiating through the pipes from the descending vapour or steam; this heating being assisted by the circulation of the treated tar through the chamber C^1. The crude oil or the like thus passes out through the pipe G "at a suitable temperature."

Gas-Meters.—No. 111,962.

SOUTH METROPOLITAN GAS COMPANY and SOMERVILLE, J. M.

No. 3704; March 14, 1917.

It has been proposed, the patentees point out, to apply to the measuring drum of a wet meter clockwork mechanism to regulate the flow of gas, so that a unit quantity of gas shall be supplied in unit time; and in connection with the mechanism it has been suggested to provide a compensating device (such as a system of aneroid chambers) to operate on the clockwork, so as to cause the latter to automatically vary the rate of flow to compensate for the effects of changes in temperature and in barometric pressure. It has also been proposed to compensate for variations in temperature and pressure by diminishing or increasing the volume of water contained in the meter—utilizing water-chambers communicating with the meter water space and plungers in such chambers actuated by a hermetically sealed vessel and caused to transfer water to or from the meter in accordance with the atmospheric conditions for the time being prevailing.

Their proposal is to employ an escapement or equivalent device to ensure a regular rotation of the meter drum, which is driven by the pressure of the gas; also means for varying the water level in the meter—comprising a system of aneroid chambers partly enclosed in a hermetically sealed compartment and partly immersed in a vessel containing water and communicating with the water space of the meter. The two portions of the system of aneroid chambers, though distinct, are connected together so that the portion which responds to the variations in atmospheric temperature and pressure imparts its movements to the portion immersed in the water. Thus the collapse or expansion which follows the changes in atmospheric conditions results in the displacement of water to a corresponding extent; and the transfer of a volume of water to or from the meter water space increases or reduces the liquid seal of the revolving drum, the rotation of which is maintained constant by the escapement mechanism with which it is provided. Provision is thus made whereby the level of water required to suit standard conditions may be supplied; so that "when a scale to correspond is fitted, an accurate reading without calculations or delays is always obtainable for the valuing of illuminating and calorific powers or for comparative measurements for other purposes."

The meter casing A contains a drum driven (as usual) by the gas pressure and caused to maintain a constant speed of rotation by escapement mechanism of any suitable kind. B is a separate chamber communicating with the interior of the meter by pipes C D above and below the water level. Within the chamber B is a system of aneroid chambers E F; the portion E being hermetically sealed, while F is open to the atmosphere by the pipe G. The portions E F are connected mechanically by a rod H. The level of the water in the chamber B is the same as in the meter, and it completely submerges the portion F of the aneroid system. The space between the water level in the chamber B and the hermetically sealed portion is open to the pressure of the gas passing through the meter; so that the pressure on the surface of the water is the same throughout. I is a thermometer; J, an inspection window; and K an outlet for the water.

The effect of the varying atmospheric conditions upon the upper sealed chamber E is such as to cause the membranes to expand and contract under the varying conditions. In such movements, the rod H connecting the lower chamber F (open to the atmospheric pressure) causes the rise and fall of the collapsible body placed within the water; thereby creating a displacement of the water when the atmospheric effect causes a contraction of the hermetically sealed chamber and an induction of the liquid when the expansion of the upper chamber causes a compression of the lower collapsible chamber F. The drum therefore, being provided with a regular delivery, when the atmospheric conditions consist of a high barometer and a low temperature (thus contracting the upper chamber of the automatic regulator of the water level), the water is expelled from the chamber into the meter and so, in accordance with the rise of the level and consequent diminution of the cubical content of the measuring drum, the volume delivered is less than that which would be obtained under standard conditions. The converse is obtained by the reverse action—viz., the expansion of the hermetically sealed chamber and the compression of the lower collapsible chamber causes a void which is followed by the return of the water from the meter drum chamber into the automatic regulating chamber; and under these conditions the volume delivered by the meter will be greater than that which would be received under standard conditions.

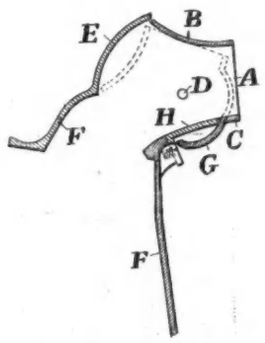
Having ascertained the bulk of water required to effect the registration of the meter to the effect of 1 p.ct., a scale may be provided which enables the apparatus to be water-lined at all times, and thus prevents any waiting for the barometer and thermometer to reach the standard points.

Gas-Fires.—No. 111,977.

YATES, H. JAMES, of Aston, Birmingham.

No. 7950; June 2, 1917.

In these gas-fires there is employed an angularly adjustable outlet nozzle at the rear of the apparatus described in patent No. 12,241 of 1910, wherein, and also in a later patent (No. 105,304), means are described for mounting the adjustable nozzle at the outlet aperture of the gas-fire, and for securing it in position after adjustment.

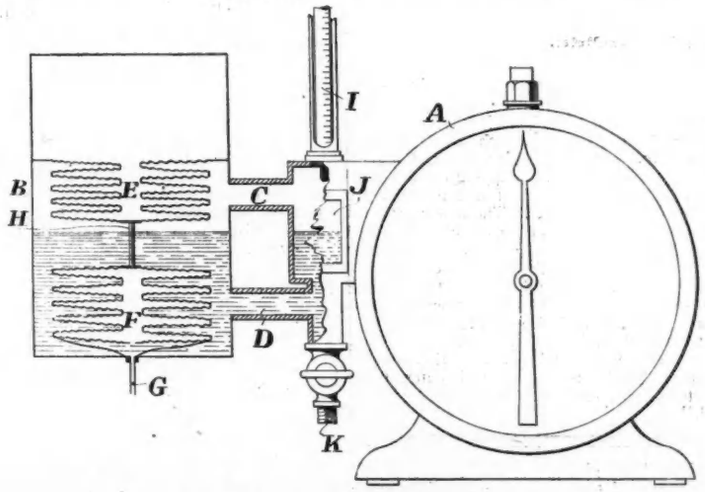


Yates's Adjustable Gas-Fire Outlet Nozzle.

The illustration is a diagrammatic section showing the adjustable mounting of a nozzle on a gas-fire in accordance with this invention.

At the inner end, or the end adjacent the rear of the fire, the adjustable nozzle A is bell-mouthed, and its upper side B projects towards the fire in advance of the lower side C. The nozzle is pivotally mounted on a transversely disposed bolt or end trunnion D, so that the projecting upper side enters a concave bell-mouthed or socket-like part E at the outlet of the fire frame or body F. The lower side of the nozzle has a concave part G adapted to serve as a socket-like part with respect to a corresponding spigot-like part H projecting from the fire.

Angular adjustment of the nozzle with respect to the fire outlet is effected by moving it upon its pivotal support in the ordinary way.



Somerville's (South Metropolitan Gas Company) Gas-Meter.

During the adjustment the upper side B of the nozzle (at its inner or fire end) moves along the adjacent inner surface of the part E at the outlet of the fire, while the lower side G moves over the outer surface of the projection H, as shown by full and dotted lines.

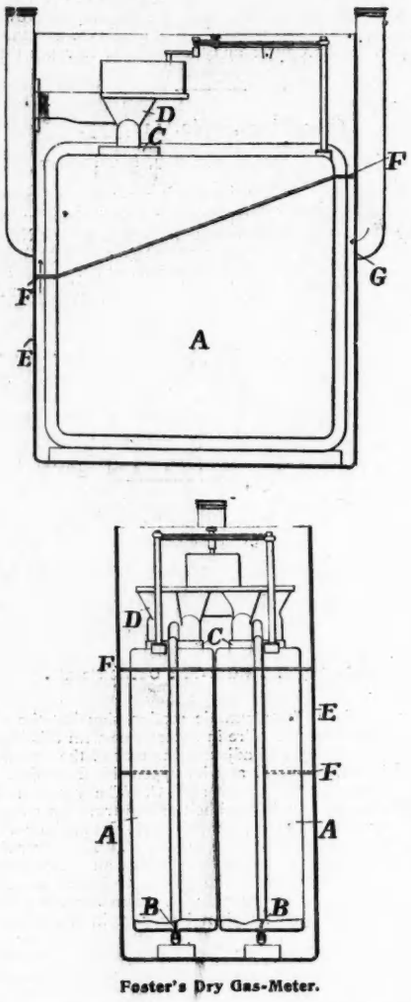
When adjusted to the position required to suit the flue or chimney with which the fire is to be connected, the nozzle is secured by a screw engaging the spigot-like projection from the fire.

Dry Gas-Meters.—No. 111,971.

FOSTER, J., of Erdington, near Birmingham.

No. 6711; May 11, 1917.

This invention has for its object to protect the usual leather diaphragms of dry meters against the deteriorating action of condensates, and also to facilitate the manufacture and repair of such meters. It comprises the construction of the measuring chambers and valve mechanism (or the meter proper) independently of the case, and the provision between the meter and the case of a chamber which serves as a condenser and a receptacle for condensates—the gas passing through the condenser before it enters the valves and measuring chambers.



Foster's Dry Gas-Meter.

The illustration is a sectional front and end elevation showing diagrammatically a meter constructed as proposed.

Two pairs of measuring chambers A are used, as heretofore, constructed from flanged dishes; the flanged edges of each pair gripping a leather diaphragm B between them. Over each pair of flanged edges a metal strip of trough section is secured for tightly clipping the flanges and producing a gas-tight joint. On the upper side of each measuring chamber is a seating C to connect a valve block D. The meter proper is enclosed in a case E, between which and the measuring chambers is a space fitted with baffles as F attached to the case or the measuring chambers, so that the gas entering at G must first take a circuitous course around the space before it can reach the valves on the upper side of the measuring chambers. The space between the case and the measuring chambers serves as a condenser and also as a receptacle for condensates. It is "sufficient to allow a relatively large accumulation of condensate, so that the meter can operate without attention for a long time." By separating the condensible matter before it enters the measuring chambers, "the deteriorating effect of condensates on the leather diaphragms is avoided."

The Oldbury Gas Committee have given the employees at the gas-works the increase in war wages of 5s. per week granted by the Committee on Production to the engineering trades.

MISCELLANEOUS NEWS.

LEEDS UNIVERSITY LECTURES.

Department of Coal Gas and Fuel Industries with Metallurgy.

In connection with the work of the Department, arrangements have been made for the delivery, during the second term of the session 1917-18, of the following special courses of lectures, open to all persons engaged in any branch of the industries concerned.

I.—OIL-WASHING AND THE NAPHTHALENE PROBLEM.

A series of four lectures will be given by Mr. A. Edwards, the Chief Chemist to the Leeds Corporation Gas Department, at 6 p.m. and 8 p.m. on the Wednesday evenings, March 6 and 13, 1918. Fee for the course, 10s. 6d.

SYLLABUS.

1 and 2.—Vapour pressures. Characteristics and proportion of wash oil; parts of plant and their functions; rectification.

3 and 4.—Naphthalene. Conditions governing formation in retorts; saturation limits and deposition of solid; effect of other hydrocarbons present in gas; special conditions produced by washing; estimation.

II.—RECENT DEVELOPMENTS IN CARBONIZING PRACTICE.

A series of four lectures will be given by Mr. E. W. Smith, M.Sc., F.I.C., the Chief Chemist to the Birmingham Corporation Gas Department, at 6 p.m. and 8 p.m., on the Wednesday evenings, March 20 and 27, 1918. Fee for the course, 10s. 6d.

SYLLABUS.

1.—Economics of gas manufacture, with special reference to gas makes and calorific value.

2 and 3.—Comparison of conditions and results in the carbonization of coal at high and low temperatures, with special reference to the use of steam.

4.—Internal and external producers and their application to the heating of settings, with special reference to the classification of coke.

III.—REFRACTORY MATERIALS.

A course of eight lectures by Prof. John W. Cobb, B.Sc., F.I.C., will be given on Tuesday evenings, at 6 p.m. and 8 p.m., commencing Tuesday, Feb. 5, 1918. Fee for the course, 15s.

SYLLABUS.

Physical and chemical introduction. The properties and composition of the raw materials. The principles and methods of manufacture and testing. Silica, ganister, alumina, bauxite, kaolin, fire-clays, magnesia, chromite, graphite, dolomite. Grinding, grading, moulding, pressing, drying and burning, shrinkage, expansion and contraction, refractoriness. High-temperature furnaces and testing. Choice and use of refractory materials for gas retorts and settings, coke-ovens, steel, and metallurgical furnaces.

IV.—EVENING LABORATORY COURSE.

(Prof. COBB and Mr. HODSMAN.)

The laboratory of the Department will be open on Wednesday evenings between 6 p.m. and 9 p.m. from Jan. 23 to Feb. 27, 1918, for a limited number of students who have already received some chemical training, but who desire some instruction in fuel and metallurgical laboratory methods. The analysis of benzols, wash oils, and tars for benzene and toluene will be included. Fee, 10s. 6d., together with a deposit (returnable) of 10s. to cover breakages. The earliest possible application from intending students is requested.

V.—DAY LECTURE COURSES, 1917-18.

For information respecting the day lecture courses in the Coal Gas and Fuel Industries Department of the University—namely, chemistry of gases, technology of fuel, gas producer practice, general and non-ferrous metallurgy, blast-furnace practice, iron and steel, alloys and metallography—see the special prospectus of the Department, in which will be found particulars of scholarships and exhibitions available. The prospectus may be obtained on application to the Secretary of the University.

VI.—ADMISSION OF STUDENTS, INQUIRIES, &c.

Intending students are requested to send in their names without delay to the Secretary of the University, specifying at the same time what course or courses they wish to attend. Other inquiries regarding the courses should be addressed to Prof. Cobb, the Head of the Department of Coal Gas and Fuel Industries.

The University reserves the right to decide that any course shall not be given if the number of entries is inadequate, or if the technical services of the Department are further requisitioned for national purposes.

NOTTINGHAM GAS SUPPLY.

Though no reason exists for undue alarm, it has been made manifest by the Nottingham Gas Committee that present abnormal conditions demand the exercise of rigid economy on the part of consumers.

Official intimation has been made as to limitation, or, failing that, a partial cessation of supply during certain hours of the day, should the warnings fall on deaf ears. The stock of coal, it is pointed out in

a notice issued by the Town Clerk (Mr. W. J. Board), is at present very low, and is being rapidly depleted. There is also the difficulty of obtaining railway wagons for the transport of fuel. Therefore, "unless gas is used by consumers with the greatest economy, especially during the present cold weather, when the consumption is heaviest, the Committee feel that it will become necessary to limit the supply to certain hours of the day, or otherwise reduce the pressure throughout the district." Apart from the difficulty of obtaining adequate coal supplies, the question of transport is every day increasing the complexity of the problem. Meanwhile, some criticism has been forthcoming as to the alleged encouragement given by the Committee to the consumption of millions of cubic feet of gas by its unrestricted use in connection with "gas-bag" motors; it being urged that this is inconsistent with the threatened interference with domestic supplies. But official information has been vouchsafed that herein grave misconception has arisen from want of information of the real circumstances; the quantity supplied in one week to fifty cars in the city amounting to 12,000 c.ft. only, which a ton of coal will produce. The whole of the gas taken from the mains for motor purposes is so small as to have no perceptible bearing upon the problem of general supply.

HASTINGS TOWN COUNCIL AND THE GAS COMPANY.

Opposition to the Proposed Modifications.

Much of the time devoted to the last meeting of the Hastings Town Council was taken up by a discussion on gas supply matters, which arose on a lengthy report by the Joint Law and Parliamentary and Electricity and Public Lighting Committee on the question of opposition to the Bill of the Hastings and St. Leonards Gas Company.

It was stated, in the first place, that the Company had applied to the Board of Trade under the Gas (Standard of Calorific Power) Act, 1916, for an Order substituting a calorific power standard of 500 B.Th.U. gross for the prescribed standard of illuminating power. The Company were asked whether they would be prepared to accept an Order limited in point of time to six months after the termination of the war; and Mr. W. R. Herring was called in to advise the Committee. Formal objection to the Order was then lodged; and the course of the subsequent negotiations was indicated in the report. In further representations to the Board of Trade, the following appeared: The Council respectfully submit that an inquiry should be held with reference to the Company's application; and, further, that their advisers should be permitted to see a draft of any Order which the Board may propose to issue in consequence of the Company's application, and ask that any amendments which may be proposed thereto may be considered.

The report then proceeded: With reference to the inquiries made by the Town Clerk from other boroughs, with a view to joint action being taken, a conference was eventually arranged by the Town Clerk of Swansea, which the Town Clerk of Hastings attended. A lengthy discussion took place with regard to the applications being made by the various gas companies; and all were agreed that the Board of Trade should not make any further Orders without full and proper provisions being inserted therein for the protection of gas consumers. A deputation to the Board of Trade consisting of Alderman T. Merrells, ex-Mayor of Swansea, and the Town Clerks of Swansea and Northampton, the Clerk to the Ilford Urban District Council, and the Town Clerk of Hastings, being received by Mr. Garnham Roper, Assistant Secretary, who was informed that the deputation were prepared to recommend their respective authorities to agree to the expenditure incurred by the companies being met out of revenue instead of being charged to capital account, in which event the companies would reimburse themselves before the consumers got the benefit of any concession which might be granted. The question of a reduction of the standard or maximum price was referred to; and Mr. Roper suggested that the Board had no powers under the Act to consider anything arising out of the change to the calorific test other than standard or pressure. But it was pleaded in reply that this made it doubly necessary to restrict the period for revision to one more nearly approximating the period of the war and a short time thereafter; and Mr. Roper was informed that the deputation did not accept the construction of the Act which he had placed upon it. Mr. Roper further stated that the Board were granting no Orders to companies who had not either put in, or were putting in, plant for the washing of the gas. A revision of the clause relating to the periodic consideration of the question was put in by the Town Clerk of Swansea (after consultation with the other members of the deputation) fixing the time at twelve months after the period of the war as the one in which the authorities could raise all other questions arising out of the proposal to supply a 500 B.Th.U. gas. The receipt of the Board's intimation, if unfavourable, would leave each place free to take its own course of action with regard to its own particular case. Reference was again made to the maximum price companies and the sliding-scale companies; and Mr. Roper inquired what was being done with regard to local authorities' gas supplies. It was pointed out that, in the case of undertakings owned by local authorities, all the benefits accruing belong to the common purse; and, furthermore, that the local authorities could themselves at any time revert to the former quality of their gas without additional powers, or otherwise, and their position was quite different from that of local authorities having gas companies within their area.

Later, it was decided to have tests made of the illuminating and calorific values of the gas, and also chemical tests; and commenting on the results of one series, Mr. Herring said: The results given are confirmatory of the estimates I had made on former occasions, and, in my view, show that the Company have depreciated the value of the gas supplied to a much greater degree than is necessary to provide the essential products for the High Explosives Department of the Government. I have already explained that the extraction from the gas of the products required by the High Explosives Department, while largely reducing the illuminating power, only reduces the calorific power of the gas by 5 p.ct. On this basis, the Company should now be supplying a gas of 520 to 525 B.Th.U. calorific value, as against the 452 B.Th.U. actually supplied on the date in question. From the chemical analysis of the gas, it is made clear that the cause for such a low calorific value arises in consequence of the dilution of the gas, in the process of manufacture, with a large percentage of non-combustible constituents, for which there is no justification whatever.

The report then referred to the Company's Bill for dealing with "financial hardships," and concluded with the following recommendations by the Committee:

1.—That the action taken in connection with the Gas Company's application under the Gas (Standard of Calorific Power) Act, 1916, be approved and confirmed.
2.—That in future steps should be taken to have regular and frequent tests made of the gas supplied within the borough, and the results recorded.
3.—That the Council become members of the Association of Local Authorities Not Owning Gas Undertakings, and authorize the Town Clerk to attend meetings of that Association and the Committee of the Association.
4.—That the Town Clerk be instructed to take all necessary steps to oppose the Bill which is being promoted by the Gas Company in the ensuing session of Parliament, either through the Association referred to in recommendation No. 3, or independently, or by both methods, as may be deemed advisable; and that a Sub-Committee be appointed to deal with the said opposition in conjunction with the Town Clerk, and to give him such directions as they may deem advisable in connection therewith.

Mr. MORGAN, in moving that it be entered on the minutes, and that the Council approve the recommendations, said they desired to make all allowances for the Gas Company upon the difficulties of coal supply, &c.; but the tests showed that, unless action were taken to safeguard consumers, there was a danger that they would be supplied with a commodity which was much below what it should be. The percentage of non-combustible constituents in the gas was an important matter, as they were nearly three times as much as they ought to be. It was the more important when it was considered that the price had risen to 4s. 2d. to-day, and the necessity involved of using much more gas than should be required. The local authorities not owning gas undertakings had formed themselves into an Association; and the expenses would be borne by the authorities according to their rateable value. The tests were made without notice to the Company. Irregular tests could be made at any time.

Mr. BLACKMAN formally seconded the motion, which was adopted.

Mr. MORGAN, dealing with the sliding-scale of the Company, said that under the new scheme the rise in the price of gas to 4s. 2d. per 1000 c.ft. would mean a reduction of 12s. 6d. per £100 of stock in the dividend; and the Bill aimed at avoiding this.

The report as a whole was carried unanimously.

NEWRY GAS UNDERTAKING.

Mr. J. A. Reddy, Irish Local Government Auditor, in his report on the accounts of the Newry gas undertaking for the year ended March last, states that the total receipts, both for gas and some of the residual products, were substantially higher than in the previous year; while the payments appeared to be lower. There was a sum of £2220 remaining due for coal. There were no bad debts written off; and in the conditions that prevailed the trading must be considered good.

Mr. Isaac Carr, of Widnes, the Council's Consulting Engineer, reported that the accounts showed a balance of £531 to credit, against £142 in 1916. The cost of manufacture, maintenance, and distribution of gas per 1000 c.ft. sold came out at 30·98d.—an increase of only 2·83d. on the previous year, and of only 3·35d. over 1913. Having regard to the abnormal cost of everything, this might be accepted as a very satisfactory result. The cost of coal carbonized per 1000 c.ft. of gas sold came out at 37·57d.—an increase of 12·64d. on the previous year. The leakage had been brought down to 4·6 p.ct. of that made, against 7·5 in 1916, 9·7 in 1915, 21·9 in 1914, and 36·2 in 1913. An appreciation of the value of the reduction in the leakage in conjunction with the improvement in the carbonizing results might be obtained by considering the quantity of gas sold per ton of coal carbonized; the figures being: 1913, 6610 c.ft.; 1914, 8530; 1915, 10,435; 1916, 11,108; and 1917, 11,254. Had the 1913 carbonizing and distribution results obtained in 1917 the coal used would have been 1837 tons more to meet the demand; and the value of this at the present contract price of 37s. 9d. per ton would amount to £3465. Had the sales of gas in 1917 remained as in 1913, the saving in the coal bill would have amounted to £4125. These figures represented the gross saving in the coal bill, and were subject to correction for the residuals that would have been sold had the extra quantity of coal been used. The coke sold per ton of coal carbonized—9 cwt.—was the best result obtained for a number of years past. The quantity of tar sold per ton of coal carbonized—10 gallons—was a proper average. The sulphate of ammonia made per ton of coal carbonized was 19·6 lbs., as compared with 17·1 lbs. in 1916; 19 lbs. in 1915; 16·8 lbs. in 1914; and 4·9 lbs. in 1913. With suggested improvements in the scrubber, the quantity of sulphate made per ton of coal should be further increased. When coals and other materials could be obtained at anything approaching normal prices, a very substantial reduction in the selling price of gas (now 5s. 3d. per 1000 c.ft.) could be made. Generally, the condition of the works continued to show an improvement, and the plant was well maintained.

Conditions of Gas Manufacture at Carlisle.—The Carlisle Corporation Gas Committee have resolved that, the Gas Engineer (Mr. E. George Hutchinson) having from time to time reported to the Committee on the obsolete conditions of manufacture prevailing at the gas-works, as also on the inefficient distribution plant, a Consulting Engineer be called in to confer with the Gas Engineer on the matter, and report thereon.

MATLOCK BATH PROVISIONAL ORDER.

Seeking a Revised Maximum.

The Matlock Bath Urban District Council have applied to the Local Government Board for the issue of a Provisional Order under the Public Health Act, 1875, to partially repeal, alter, or amend the Matlock Bath Gas Act of 1896, so as to enable them to increase by 2s. per 1000 c.ft. the maximum price which the Council are authorized to charge for gas.

An inquiry into the application will be held by the Board.

STRIKE AT THE PERTH GAS-WORKS.

Perth has been experiencing the inconveniences of a gas shortage, which ensued from a strike of Corporation employees, including gas workers and lamp lighters. The men ceased work on the morning of last Thursday week; and on the following day the supply of gas in the holders gave out, and those works which depended upon gas power were in this respect brought to a standstill. However, in the course of the morning Mr. Liddle (a representative of the Ministry of Munitions) arrived in Perth; and as the result of a conference with the men, a settlement was, so far as the gas-works were concerned, arrived at—the men consenting to return to work on condition that (failing the efforts of a conciliator to be appointed by the Ministry of Labour) the matters in dispute should be submitted to arbitration by the Government Departments concerned.

The dispute arose between the Corporation and a number of their employees over a demand for an increase of 8s. per week in wages. About 120 employees were affected; the departments involved being the gas-works, the meter and gas-fitting department, the street sweepers, the fire and lighting, and the work and paving department. The Town Council were informed by Sir George Askwith (the Chief Industrial Commissioner) that the men in the gas-works had wrongfully ceased work, as it is a controlled establishment under the Munitions Act. On behalf of the Town Council, a communication was made to each individual worker in the gas-works, advising him to return to his employment, and pointing out that, under the Defence of the Realm Act Regulations, each was liable to prosecution. It was also understood that an offer was made that, on resumption, their case could be considered while work was going on.

In all, about eighty large consumers were seriously affected by the breakdown in the supply; nearly forty gas-engines being thrown idle. The formal opening of a new communal kitchen had to be postponed; and over the week-end, while the shortage lasted, private consumers suffered troubles of various kinds.

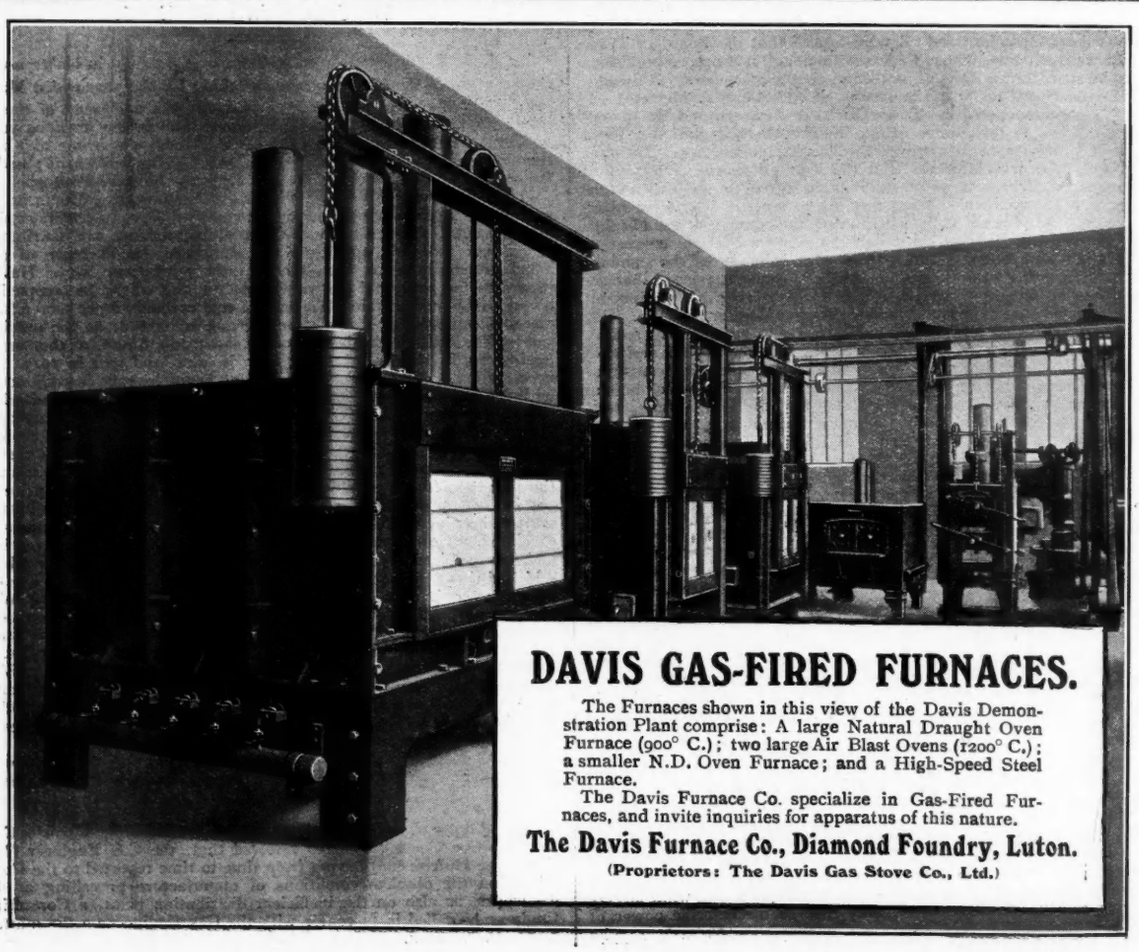
GAS FOR MOTOR VEHICLES.

The Malvern Urban District Council have received an application from the Birmingham and Midland Motor Omnibus Company for a supply of gas for motor traction by meter, at power rates. The Council have decided to provide a supply at 3s. 4d. per 1000 c.ft.; the Company to pay the cost of the meter and the connections by five annual instalments.

Major T. C. Huth was last Friday prosecuted by the Aldershot Lighting Company for disconnecting a gas-pipe at Camberley and obtaining a supply of gas which did not pass through the meter. He pleaded guilty. It was stated that defendant disconnected the supply pipe of his house on the Company's side of the meter; and, by inserting an india-rubber tube, filled the gas-bag of a motor without the gas passing through the meter. The action was detected by an employee of the Company who happened to be cycling past Major Huth's residence. Defendant then admitted it had been done nine or twelve times. A fine of £9 and three guineas costs was imposed.

The "American Gas Engineering Journal" mentions that the first motor-car driven by town gas has been put on the streets of New York City by the constructing engineers on the staff of the Consolidated Gas Company. It consists of a smart-looking Cadillac limousine which for some time has been engaged in the service of the Company, weight 4¼ cwt., with a gasolene running capability of six miles per gallon. The outward appearance is so little changed that the public, generally so keenly alive to novelty, have failed to notice it; the only addition being a steel cylinder 8 in. in diameter and 45 in. long, fixed on the running board, and provided with two ½-in. connections—for charging and for delivery to the carburettor. A high-pressure valve and gauge are so placed that the driver can readily control the supply of gas to the engine from his seat. The container can be placed in the rear or in any convenient position on the car. According to tests made by Mr. W. C. Morris and his assistants with this home-made arrangement, 273 c.ft. of gas are equal to a gallon of gasolene for motor work; but much better results could be obtained with specially-designed compressing plant and car. The mileage would, of course, be affected by the quality of the gas; and with a pressure of 2000 lbs. in the cylinder, many miles could be covered before a refill was necessary.

Urging the need for a Road Transport Executive and a strong traffic man, the "Commercial Motor" remarks as follows on heavy vehicles and coal gas: There is one other detail—among many—where the hand of the strong man is required. Many owners of heavy motor vehicles, consumers of large quantities of petrol, are not making any noticeable effort to equip those vehicles for running on coal gas. Why? They will tell you that on the country roads the overhanging branches of trees damage the bags. Arches and bridges are often too low to allow them to pass under. Entrances to buildings are often not high enough to pass the gas-bag. The trailer does not, in many cases


DAVIS GAS-FIRED FURNACES.
The Furnaces shown in this view of the Davis Demonstration Plant comprise: A large Natural Draught Oven Furnace (900° C.); two large Air Blast Ovens (1200° C.); a smaller N.D. Oven Furnace; and a High-Speed Steel Furnace.
The Davis Furnace Co. specialize in Gas-Fired Furnaces, and invite inquiries for apparatus of this nature.
The Davis Furnace Co., Diamond Foundry, Luton.
(Proprietors: The Davis Gas Stove Co., Ltd.)

where heavy vehicles are concerned, meet the case, because of the extra manœuvring space involved and the reversing difficulty. Then, again, the varying nature in distance and direction of deliveries, coupled with the need for obtaining a refill of gas, introduces the element of doubt. Other objections to the use of gas carried in the flexible type of container are urged. But the solution of the difficulty is to be found in the one word—"compression." If our live transport department would set to work to encourage the use of coal gas, would urge the advisability of providing facilities for manufacture and supply of necessary cylinders and compressing plant, and then, if there was still evidence of reluctance to save petrol by using coal gas, to order the adoption of the alternative fuel in districts where there is an available supply.

Much interest in Scotland is taken in the new Order by the Board of Trade controlling the use of gas for driving motor vehicles [see p. 109]. The use of gas is being taken advantage of to a considerable extent by large cars for passengers, and also to some degree by commercial vehicles.

GERMAN DYE SECRETS CAPTURED.

A Severe Defeat for German Commerce.

Last Thursday's "Daily Mail" contained a very interesting article reporting that the essential recipes of 257 German dyes are now in British possession—one of the greatest blows that could have been delivered to German commerce. Dyes, it was pointed out, constitute a key to many industries in which Britain hitherto could not compete because of the possession by Germany of the secrets of the manufacture of cheap dyes.

The article proceeds: After two years' persistent effort, a group of men in the British textile trade has succeeded in bringing to England from Switzerland the secret recipes of the great German dye industry. This is a capture of the first importance in the economic war against Germany and German trade. It will free the British textile industry and scores of other important industries from the bonds of Germany. It means that when the war is over Great Britain will be in a position to compete equally with Germany in the matter of dyed goods in every market in the world.

But more than that, the aniline dye industry is of extraordinary importance because it is a "key industry," dominating a large number of other trades, and of vital importance in war. On the cheap supply of dyes depend our textile industries, with an output of more than £200,000,000 a year. Her dye monopoly before the war gave Germany an export trade in fine chemicals of £97,500,000, according to Prof. Grossmann. It gave her an almost complete monopoly in the large scale output of explosives, gases, photographic chemicals, drugs, and sources of power derived from splitting-up petroleum and gas-tar products.

The British textile merchants who have succeeded in capturing the recipes do not intend to form a monopoly in this country. They have refused tempting offers from capitalists. It is their intention to offer the recipes to the British Government for use in already established works. Their sole desire is to secure for the whole of the textile industry of England a full and cheap supply of fast dyes, stable and true to colour.

Mr. John Leyland and Mr. Richard Baldry are the two men who have been chiefly instrumental in the capture of the recipes. Associated with them is a group of textile merchants like themselves. These gentlemen sent a representative to Switzerland, where they heard there was a chemist with the secrets in his possession; and as a result Mr. F. M. Rowe, M.Sc., of the Manchester School of Technology, who has worked in the Badische factories, was also sent out. The Bradford Dyers' Association was asked to name the dye which they considered to be the most difficult to procure and manufacture, said Mr. Leyland in the course of an interview. It was stated that they would be satisfied if Mr. Rowe produced from the recipe of the Swiss chemist a dye known as Brunt-green—an apple-green colour.

The chemist selected this recipe from the 257 which he held, and the work began. As soon as Mr. Rowe saw the recipe—speaking from a life-long knowledge of the technical science of dye-making—he declared that the recipe was useless and that he had been sent to Switzerland on a fool's errand. The chemist asserted that the recipe was the one which would produce the apple-green.

Mr. Rowe, having first tested each ingredient separately, proceeded with the experiment. To his utter amazement the recipe was correct, and the dye was produced.

Specimens of the dye in all stages of manufacture are now in London, and Mr. Rowe is in Manchester working out other recipes and producing by degrees the whole range which once could only be obtained in Germany.

Mr. Rowe proceeded: We are indebted to the Foreign Office for placing every facility at our disposal. In fact, without the aid of the Foreign Office it is doubtful whether we could have got the samples or recipes to England. Our agent was dogged by German agents on every journey he made to Switzerland. His baggage was stolen; he was drugged and assaulted and thrown into the gutter. He was followed once by two men as far as Havre. He reported the facts to the French authorities, and they succeeded in capturing two undoubted German agents. On one occasion he was travelling with a diplomat whose baggage was marked with the same initial as his own. This gentleman's baggage was also stolen *en route*. While the German agents were paying these attentions to our representative, the recipes and samples were travelling securely to England in a Foreign Office bag. They are now safely locked up in the strong room of a bank and beyond any danger of theft or recovery by the Germans.

ON account of the pressing need for Gas Heating Apparatus, especially Gas Steam Radiators for Munition Works, and the shortage of material and labour, we should be pleased to hear from customers having apparatus for disposal of recent manufacture out of use through shortage of gas supplies or other reasons.

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WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM
SHOW-ROOMS AND BRANCHES: 25, PRINCES STREET, OXFORD CIRCUS, W.; 82, Gordon Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

AMERICAN OFFICE AND COLLECTION METHODS.

Some interesting details of American practice in the rental office were revealed in a paper read by Mr. Buckminster at a meeting of the Gas Sales Association of New England.

In dissecting statistics supplied by a dozen representative gas undertakings, he showed that the class and status of the population supplied influenced methods of business. People earning a weekly wage preferred instalment systems, while other classes would appreciate cash discounts. The percentage of slot-meters as compared with the total, ranged from 2 to 65; but the utility of this appliance as an assistant to the collection did not appear to be fully appreciated. It could be set slow until an old-standing appliance debt was clear, and, if thus applied, should be painted a distinctive colour.

An official called the credit clerk looks after the arrears and overdue accounts, and is sometimes encouraged by a bonus on a reduced unpaid balance. Small gas companies favour periodical meter-readings, while larger ones work on the continuous plan. But in either case the accounts are rendered monthly, with a cash discount period of ten days. The risk of theft or damage to which slot-meters were subject was insignificant as compared with the improved results. Personally, the author did not believe in collectors except for special cases; and as a rule the result of adopting notices in their place was satisfactory. An excessive number of personal visits or duplication of notices was an unnecessary expense. Two reminders, exclusive of the cut off, would bring better results than three or four.

The cash discount was helpful both to full and to instalment sales; and the prompt rendering of all accounts was most essential. Salesmen should be cautioned not to suggest or favour credit after effecting a sale. In place of the stereotyped inquiry, "Shall we book it?" or "Have you an account with us?" he should enlarge on the advantage of cash payment, or even suggest "We feel almost obliged to ask for cash on small purchases." Special effort should be made in the way of replacing credit or instalment by cash sales. Intelligent maintenance men were a great assistance in the sale of appliances, besides creating satisfied consumers, and a good show for gas. A deposit system was invariably attended with more or less annoyance, as consumers had a very keen sense of the value of money thus locked up.

Lurgan Price Revision Inquiry.—Mr. A. D. Price, Local Government Board Engineering Inspector, held an inquiry at Lurgan into the Urban Council's application for an amendment of the local Act of 1915 to enable the raising of the limit of the gas price from 4s. 6d. to 6s. 6d. per 1000 c.ft. Opposition was tendered by Mr. R. Best, K.C., on behalf of about 1290 ratepayers. Mr. F. W. Pollock, Town Clerk, said that, unless power was given to raise the price of gas, there would be an increase in the rates by 10d. in the pound.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 14.

The market for pitch continues steady. It is reported that further sales have been made during the past week at over 50s. per ton f.o.b. makers' works; but business is largely dependent upon the amount of freight offering. There are a fair number of inquiries in the market for tar for road work over the coming season; but business can only be done under licence from the Ministry of Munitions. Solvent naphtha is steady at about 4s. 3d. to 4s. 6d. per gallon net and naked at makers' works. Stocks of creosote are being kept clear, on the terms arranged by the Government. In other products, there is nothing of special interest to record.

Sulphate of ammonia already purchased under contract is being taken up by consumers at a fast rate, and there is little further material available for sale in the London district over the next few months.

Tar Products in the Provinces.

Jan. 14.

There is nothing fresh to report concerning the market for tar products.

The average values for gas-works products during the week were: Gas-works coal tar, 27s. 6d. to 31s. 6d. Pitch, East Coast 20s. to 25s. per ton; West Coast—Manchester 18s. 6d. to 19s. 6d., Liverpool 19s. 6d. to 20s. 6d., Clyde 19s. 6d. to 20s. 6d., nominal. Benzol 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha in bulk, North, 7⅞d. to 8½d. Solvent naphtha, naked, North, 3s. 10d. to 4s. Heavy naphtha, North, 2s. to 2s. 3d. Creosote, in bulk, North 3¾d. to 4¼d. Heavy oils, in bulk, North 4¼d. to 4½d. Carbolic acid, 60 p.ct. East and West Coasts, 3s. 4d. naked. Naphthalene salts, 80s. to 90s., bags included. Anthracene, "A" quality, 3d. per unit; "B" quality, 1½d. to 2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

With the exception of Cumberland, where shortage of coal has interfered with the full working of plants, the production of by-products is generally on the increase; the present exceptional demand for cokes of all grades necessitating the use of all possible ovens. There is, however, no material change in market conditions. Pitch

THE "MARS"
- - GAS-HEATED STEAM - -
RADIATOR

THE "Acme" of perfection in heating, it is entirely self-contained and requires no steam or water connections. The heat is regulated by an automatic gas-valve, an even temperature is maintained, and consumption of gas economized. It is flueless and odourless. Quite simple and cheap to instal, its maintenance cost is low, and it heats a room with less gas than is required to light it. Ideal for large offices, workrooms, halls, churches, and public institutions.

Write for Special Booklet, "Healthful Heating," to
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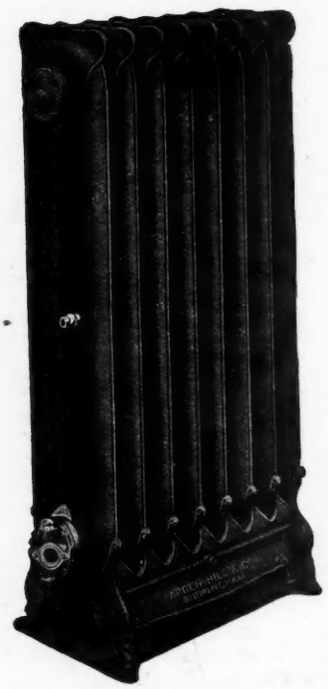

DOUBLE-COLUMN RADIATOR.

remains at 48s. per ton f.o.b. London, with 50s. asked; while on the north-east coast sellers are getting 30s. per ton for such small quantities as can be shipped. No great developments are taking place in the home trade. Provincial quotations still range from 20s. to 24s.; the lower figure being noted at Manchester, where prices are usually less than in other parts, probably on account of the absence of patent fuel works, which are large users of pitch. The latest order relating to tar may be having some restraining influence on any improvement in pitch conditions, inasmuch as, being intended to bring about the fullest possible distillation of the tar, it may also bring about the production of more pitch. As regards tar, experiments are reported from the North of England in connection with utilizing tar as a fuel. It has been proved that a full head of steam can easily be maintained; but the expense of tar is considerably higher than that of coal. Cresylic acid has been advanced in price to 3s. per gallon (the price now includes casks). Naphthas are now under control, and all transactions are subject to licence. The regulations do not affect the price as yet, however, although they are likely to be so extended should efforts, now being made in certain quarters, to force the price up further prove successful. The tendency at the week end is a trifle easier, although there is a good demand and great scarcity. Heavy naphtha is also controlled, but without change in price on the week. Naphthalenes are steadily firm at last quoted rates, with a tendency to better prices for lower grades of crude. Creosote is taken up by official requirements, and there are no free offerings of the product. Carbolic acid and anthracene are unchanged. Aniline oil is again a shade lower. The range of quotations is as follows:

Aniline Oil (pure): 1s. 2d. per lb.

Benzol: 90% London, 1s. 0½d., North 10½d. to 11¾d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East and West Coast 3s. 6d. per gallon; crystals 40% 1s. 3d. per lb.

Crude Tar: London 30s. to 35s., Midlands 25s. to 26s.; North 26s. per ton, *ex* works.

Pitch: London 48s. to 50s., f.o.b.; East Coast, 22s. to 24s. f.o.b.; West Coast—Liverpool 22s.; Manchester 22s. to 23s. f.a.s.; Clyde 22s. to 24s.

Solvent Naphtha: Naked London 90-190% 3s. to 3s. 3d.; North 2s. 9d. to 3s. per gallon; 90-160% naked London 4s. 3d. to 4s. 6d.; North 4s. to 4s. 3d. per gallon.

Crude Naphtha: Naked 30% 8½d. to 8¾d.; North 6½d. to 6¾d.

Naphthalene: Refined £32 10s. to £35; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4¼d.; North 3¾d.; heavy oil, 4½d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1¾d. to 2¼d.

Cresylic Acid: 95%, 2s. 10d. per gallon; 97-99%, 3s. per gallon, casks free, *ex* works London and f.o.b. other ports.

Grease Oils 180 Tw. (naked) £6 per ton f.o.r. makers' works.

Sulphate of Ammonia.

With nitrate of soda unobtainable, and the chances of obtaining supplies of basic slag in time for this season's use being very small, it is not surprising that the demand for sulphate of ammonia is continually increasing. This fertilizer has certainly caught on with the British farmer; but it must be remembered that he can buy it at the very low fixed price of £16 7s. 6d. per ton, which compares with £20 in an open market a year ago. Production is considered satisfactory; but it is certain that agricultural and munitions requirements will readily absorb the make during the next four or five months. Consequently, export trade looks like being held up for some time to come. The small amount of export trade being transacted is allowed for exceptional reasons, and produces higher values than ever before ruled in the trade. The volume is so small, however, as to be negligible, and without interest or effect.

In America, production continues satisfactory; every effort being made by the Government to increase the output from the bye-product and gas plants. The demand there is also very heavy for agricultural and munitions purposes, and considerable shortage is reported in aqua and anhydrous ammonia.

Athlone Gas Supply.—At a meeting of the Athlone Urban Council, Mr. John Bradley (the Gas Manager) contradicted a statement which had appeared in the Dublin Daily Press that there had been a failure of the gas supply in Christmas week, and that the town had been in darkness. Several members agreed that, not only had there been no failure, but the supply was excellent during that week. On a bill being presented for over £3827 due for coal supplied to the gasworks, the Clerk said it would be necessary to raise the price of gas. If they did not do so, they would be in bankruptcy. He agreed to bring the matter before the Gas Committee.

Shop-Lighting Restrictions.—Quoting the terms [*ante*, p. 78] of the first Order issued under the regulations which empowers the Minister of Munitions to restrict the use of any form of artificial light, the "Ironmonger," referring to the stipulation "that the light used in any part of a shop shall not exceed what is reasonably necessary," says: "As the police are to be the judges of what is reasonably necessary," we can see trouble ahead unless a standard definition is laid down. In view of the varying requirements of different businesses, we do not envy the local constable the task of telling a shopkeeper that in the opinion of the police he is using too much light. The effect of light upon the eye varies in almost every individual; and lighting experts have given up any attempt to rely upon human judgment in this matter. Perhaps a way out would be for the Minister of Munitions to engage the Illuminating Engineering Society to prepare a schedule of maximum illuminations in foot-candles for all classes of businesses, and then to provide every policeman with a portable photometer."

Future of Gas Companies' Stocks.

Referring to the steps now being taken to remove the disadvantageous restrictions under which gas undertakings labour in war-time, the "Financier and Bullionist" says: As might be expected, gas companies' stocks have been among the worst sufferers by war-time conditions; their value being depreciated not only by the rise in the value of money, but by the automatic reduction of dividends resulting from the increased prices it has been necessary to charge to consumers. However, if Parliament concedes the powers now asked for, dividends will show an appreciable increase, and purchasers of gas stocks will receive on their investment a much more satisfactory return than those accruing on the basis of present distributions. Even if Parliament vexatiously refuses to give gas companies the required relief, their ultimate restoration to a state of comparative prosperity is assured; for, while the consumption of gas is bound to increase after the war, owing to removal of the lighting restrictions and other developments, the cost of production is no less bound to show a considerable reduction. It will, therefore, be possible to reduce the price of gas, and automatically to raise rates of distribution—ultimately, if not immediately. We prefer to assume, however, that the concessions now asked for will be granted, in whole or in part, and that in the current year an increase in dividends will be allowed. If this happens, gas companies' stocks may well be regarded as promising investments at their present market valuation. Even on the basis of the statutory dividends now payable, they give comparatively satisfactory returns, allowing for the prospect of improved dividends, if not at once, at least when the war is over. Thus the Brentford Company's "A" stock yields $5\frac{6}{8}$ p.ct., the Commercial Company's 4 p.ct. stock $5\frac{3}{4}$ p.ct., the South Metropolitan Company's stock almost $5\frac{1}{2}$ p.ct., and the Wandsworth Company's "A" stock $5\frac{7}{8}$ p.ct.; while much larger returns, ranging up to 8 p.ct., are to be had on the stocks of less prominent undertakings—such as those of Ilford and Hornsey. The Gas Light and Coke Company yields only $5\frac{3}{8}$ p.ct. on the basis of the dividend now payable; but if the rate is raised with the consent of Parliament, the return accruing at the present prices will be slightly over 7 p.ct.

Gas-Works Mishap.—A mishap occurred at the Stafford Gas-Works last Tuesday, which necessitated a stoppage of the supply to power consumers. The cause was the tilting-up of the pipe conveying water between the works and the river for condensation purposes.

Stafford Gas Employees' Arbitration.—With regard to the arbitration in connection with the demand of the employees at the Stafford Gas-Works for an increase of 10s. in wages, a report has been issued stating that the proceedings took place in London, and were attended by the Gas Engineer (Mr. W. M. Valon) and two of the employees. Appreciation is expressed of the moderate and careful manner in which the case was presented, and the amicable spirit shown. It is believed the result will be satisfactory to all concerned.

Bilston Gas Light and Coke Company.—Mr. Harold Holcroft, presiding at the annual meeting of the Company, said the troubles of gas undertakings had increased with every year of the war. The present problem was the extreme difficulty of obtaining adequate supplies of coal. The Coal Control authorities apparently restricted the supply much more severely to small companies like theirs than to the larger gas undertakings. The report was approved; and a resolution was adopted that further dividends of 5s. 6d. per share on the "A" shares, less tax, and 4s. per share on the "B" shares, less tax, be paid, making, with the interim dividends, 11s. and 8s. per share respectively for the year.

Swadlincote Gas Managership.—Referring to the selection of Mr. F. Robinson, of Brecon, to succeed Mr. J. B. Balmforth as Manager of the gas-works, Mr. Beaumont (the Chairman of the Lighting Committee) explained to the members of the Swadlincote Urban District Council that they offered Mr. Balmforth an increase in salary; but this did not enable them to keep him. Mr. Robinson was second in the running at the time Mr. Balmforth was appointed; and, under these circumstances, the Committee decided to invite him to take the position. At the same time, the Council were very sorry to lose the services of Mr. Balmforth, who had improved the gas-works, and also the make of gas.

Malvern Gas Undertaking's Coal Supply.—The Malvern District Council are experiencing considerable difficulty in securing adequate supplies of coal for the gas undertaking. The Gas Engineer (Mr. S. Trow Smith) has written to the Coal Controller relative to the decrease in the supply. Between Sept. 1 and Dec. 15 he was compelled, through the shortage, to take 1033 tons of coal from stock. Owing to the increase in the price for gas-fires (the present price being 72 p.ct. over pre-war charges), the hiring rates, he says, are not nearly sufficient to recover the cost of the fires, and the Gas Committee regret that, after the present stock is exhausted, they will not be able to fix fires taken on the hire-system or purchased outright.

The steam collier "Wandle," belonging to the Wandsworth, &c., Gas Company, whose gallant fight with a submarine will be remembered, is reported by Lloyds to have gone ashore on Dec. 12, and to be completely submerged at low water.

The various municipal departments of Birmingham subscribed generously to "Tank-Week;" and the officials of the Gas Department rendered excellent assistance in making it the big success it was. The staff and officials took out bonds and certificates to the amount of £7405.

A meeting of all sections of Bradford municipal employees rejected the Corporation War Wages Committee's offer of a war bonus advance from 12s. to 16s. per week for men, 6s. to 9s. for women, and 6s. to 8s. for youths, to employees earning less than £250 per annum. Despite this rejection, the City Council have approved the Committee's offer. The matter is going to arbitration.

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Australasian Agents: MOLDEN & BUDDEN PTY., Ltd., 364A, Little Collins Street, Melbourne, Vic.; and at SYDNEY, N.S.W.

Bye-Product Coke-Ovens in America.

In their "American Engineering News" last Friday, the "Engineer" newspaper said: The war has been a great incentive to the rapid development of the bye-product coke-making process in America. At the end of 1914 the capacity was 15,000,000 tons per annum; while early in 1918 it will amount to about 30,500,000 tons. During the three years, 4037 ovens have been built or contracted for; and their investment totals to over £20,000,000. Of the total coal consumption, only about 7 p.ct. is carbonized with bye-product recovery; while in Germany the proportion is about 30 p.ct. In American practice, larger coke-oven units are employed than in European practice; and the rate of coking is more rapid, owing to the higher temperatures which are made practicable by the use of silica brick. In recent years, however, there has been a tendency to limit the size, and to balance the most advantageous coking capacity and the wall-temperature required for good yields of the bye-products. Fluctuations in demand for coke can be met by varying the coking period, and thus the rate of output; while excess of coke output can be stored or sold at low prices for fuel. From 7,500,000 gallons of light oil at a dozen bye-product plants in 1914, the output has grown to 60,000,000 gallons from 52 plants. Nearly 10,000,000 gallons of toluol per year are being made from this oil. With the end of the war, benzol and toluol will be used largely as motor fuel. Benzol, with 10 p.ct. of toluol to lower its freezing point, is an excellent motor spirit, comparable with petrol. With investment costs paid by war profits, benzol recovery plants can operate at a profit on petrol prices. For ammonia and the tar products, there is a wide and rapidly increasing field and demand.

Naphthalene and Other Troubles at Oldham.—At last Wednesday's meeting of the Oldham Gas Committee, Alderman H. Wilde (the Chairman)) presiding, it was reported that, during the recent spell of frosty weather, several fractures had occurred in the gas-mains; and in some cases these had been difficult to locate, owing to the distance away at which the gas showed itself. Naphthalene deposits had, it was stated, also been a troublesome feature of late; and since September last an expenditure of £630 had been incurred in dealing with the difficulty.

Salford Protest against the Coal Controller's Action.—At last Wednesday's meeting of the Salford Corporation, Mr. Lees asked his colleagues to pass a resolution [*ante*, p. 77] of protest "against the recent action of the Coal Control Department of the Board of Trade in advancing the pit mouth prices of coal by 2s. 6d. per ton; such advance being excessive in relation to the increase in miners' wages of 1s. 6d. per day, and unjust in its incidence when passed on to the consumer." The increase would, he said, cost the Salford Gas Committee £20,000 per annum. The Council unanimously passed the resolution, and decided to forward a copy of it to the Prime Minister, the President of the Board of Trade, and the Members of Parliament for the borough.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Jan. 9.]

Nos. 1—319.

ADAMS, H. E. F. GOOLD-.—"Production of ammonium sulphate." No. 310.
BAILEY, C. W.—See Adams. No. 310.
BEAUMONT, E. G. E.—"Gas-storage reservoirs for motor vehicles." No. 108.
BRITISH CARBONIZING COMPANY.—"Rotary furnaces." No. 246.
CLARKE, F. H.—"Incandescent gas-burners." No. 83.
DENNY, H. S.—See Adams. No. 310.
FARTHING, J. H.—"Gas fire or stove." No. 156.
FLUGEL, B. J. V. A.—"Carburettors, &c., for motor-cars employing coal gas, &c." No. 301.
HILTON, R. S.—"Apparatus for bringing gases and liquids into intimate contact." No. 218.
HOUGHTON, P. H.—"Gas-supply apparatus for motor vehicles." No. 274.
HUNTER, F.—"Reducing and economizing valve for coal, &c., gases from pressure cylinders." No. 164.
LANE, W.—See Houghton. No. 274.
MANSFIELD, F.—See Houghton. No. 274.
MORDEY, H. F.—See Houghton. No. 274.
MOYES, E. H.—"Feed-controlling devices for liquid or gaseous fluids under pressure." No. 257.
NORRIS, W. H. H.—See Adams. No. 310.
RAILING, M. J.—See Farthing. No. 156.
RICHMOND GAS STOVE AND METER COMPANY.—"Steel furnaces." No. 276.
SANDY, J. M.—See Hunter. No. 164.
THOMPSON, J.—See Richmond Company. No. 276.
TILLER, E.—"Gas-containers, &c." No. 202.
WEBB, H. F.—See Flugel. No. 301.
WESTWOOD, J. W.—"Distillation of tar, &c." No. 47.
WILLIS, J. H.—See Hilton. No. 218.
WINSTANLEY, F.—See Farthing. No. 156.

Co-Partnership in Practice.—After remarking in a New Year's greeting to the employees through the pages of the "Co-Partners' Magazine" that over 4000 of their co-workers are fighting in various parts of the world, Mr. John Miles, the Governor of the Gas Light and Coke Company, says: There is one consolation to us gas men at present, and that is that never was gas more appreciated by the Government and by the public, and if co-partners will only continue to pull together, realizing that whatever injures the Company injures themselves, there is no fear for the future prosperity of the Company.

Our Special Quick-Connecting

COUPLING

is the easiest and most simple method of connecting

GAS CONTAINERS for MOTOR VEHICLES

Specially recommended by the

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

SOLE MAKERS:

SAWER & PURVES

(BRANCH OF METERS LTD.)

Nelson Meter Works, MANCHESTER.

Radford Meter Works, NOTTINGHAM.

Coal Shortage in Ireland.—The Mullingar Town Council, on the recommendation of the Gas Manager (Mr. J. O. Halliwell), order a 50 p.ct. reduction in public lighting, owing to coal shortage. For a like reason, the Strabane Urban District Council have left in the hands of their Manager the question of reducing the public lighting.

Appeal for Economy at Stafford.—In view of the heavy demand for gas for munition works, and its use being greatly increased for industrial and domestic purposes, the Stafford Corporation have issued a special appeal to the inhabitants to exercise the strictest economy. It is imperative, the department point out, that urgent munition work should not be stopped. The increased consumption for munition purposes amounted during the present financial year to 14 million c.ft.

Looking Ahead at Oldham.—Mr. Timothy Duxbury, the Gas Engineer to the Oldham Corporation, reporting to his Committee upon the state of the gas-works, mentioned a number of items of renewal, repair, replacement, and extension which would be required at the end of the war. He said that much of the preliminary work of plans, &c., could be undertaken at once, and pointed out that the department had for two years been without a head draughtsman and a head chemist. He advised that these positions should be filled by the promotion of Mr. F. Greenhalgh and Mr. F. C. Lee respectively. Mr. Duxbury's recommendations were approved.

Explosion at the Rawmarsh Gas-Works.—A gas explosion occurred last week in a small engine-house at the gas-works of the Rawmarsh (Yorkshire) Urban District Council. A workman named Lavender Carr was killed, and another man severely injured; and the building and machinery were wrecked. The result is expected to be an almost complete absence of gas at Rawmarsh and Parkgate for a few weeks.

Coldness of Lancashire Mills.—From time to time in the "JOURNAL," reports have appeared from the secretaries of operatives' unions complaining of the coldness of Lancashire cotton-mills; and on more than one occasion it has been suggested that this was a matter which might, at some convenient opportunity, be taken up by the British Commercial Gas Association, with the view to inducing millowners (and mill architects especially) to go in for gas-heating schemes. With the war, however, the idea has in all probability been hung up for a more convenient opportunity of tackling the question. But at Oldham a strike is threatened at one of the largest mills; and a week's notices have been tendered by the spinners, on account of the refusal of the firm to pay wages in respect of a day's work recently lost through the spinners refusing to work on the ground that the rooms were too cold. During last month similar complaints have been reported from Bolton, Blackburn, Preston, Accrington, and other textile towns.

STOCK MARKET REPORT.

THE second week of the New Year brought an improvement in the general position of things on the Stock Exchange. It certainly had a quiet fit in mid-week, which came after a nice promising opening on the Monday; but it promptly shook this off, and, with restored activity and firmness, proceeded to a cheerful and satisfactory conclusion. Of actual war news with stirring despatches of great blows dealt to the enemy, there was a lack; but many small successes gave quiet indications of our strength. A remarkable feature was the persistent confidence in the recovery of Russia, testified not only by the firmness of Government issues which rose steadily, but by the demand for prior railway bonds.

The gilt-edged market on the whole did well. Home Government issues were a little affected by the competition of brisk "Tank" crusades in the cause of War Bonds; but the 5 and 4½ p.ct. Loans and Consols made some advance. Colonials, too, were in demand; and Home Rails made a recovery from their easy tendency of a week ago. Canadians were dullish, and Argentines were uncertain and fluctuating.

The Foreign Market presented some good points in addition to the Russian already noticed. French were in good demand, Chinese and Japanese maintained favour, and Mexican and several South Americans came into notice. South Africans were firm. In the Miscellaneous Group, Rubber was rather dull; but Oil continued steady. Armaments, Shipping, and Breweries were well supported. Much interest was aroused by several of the large Bank announcements with their tales of higher dividends and increased balances carried forward.

Business in the Gas Market was quieter than in the preceding week; and there were even fewer undertakings dealt in at all than then. In view of the near approach of the companies' annual or semi-annual general meetings, would-be operators are perhaps inclined to "wait and see." However, prices of such issues as had transactions in them did not suffer from the calm. On the contrary, one or two were a shade higher. Quotations, too, were quite firm and unchanged.

In the Money Market there was a good demand at firmer rates.

Bargains done for cash during the week were as follows: On Monday, Gas Light maximum 57½, 57¾, Imperial Continental 88, San Paulo preference 7½, South Metropolitan 75½, 76, Monte Video 5 p.ct. debenture 79½, 80. On Tuesday, Gas Light ordinary 68¼, 68¾, 69, ditto maximum 57¾, ditto preference 71, Imperial Continental 88, 88¼, South Metropolitan 76½. On Wednesday, Brentford "B" 78¼, Gas Light ordinary 68¾, 69, ditto preference 70½, 71, Imperial Continental 88, 88½, 88¾, South Metropolitan 75½. On Thursday, Cape Town debenture 59, Gas Light ordinary 68¾, 69, ditto maximum 57½, Imperial Continental 87¾, Primitiva preference 56s. 3d., 59s. 4½d., South Metropolitan 76¼, 76½, Southampton 76¼, 76½. On Friday, Gas Light ordinary 69, ditto maximum 57¼, 57¾, 58, Imperial Continental 89, 89½, Malta and Mediterranean 3⅞, South Metropolitan 76½, Knutsford 100, Metropolitan of Melbourne 8½, 8 3/16.

The Bank rate is 5 p.ct., as fixed on April 5.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share.	When ex-Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
176,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	57—62	..
1,551,868	"	April 8	2½	4¾%	Alliance & Dublin Ord.	59—64	52—57	..
374,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76—79	60—65	..
280,000	5	April 29	7½	3/6	Bombay, Ltd.	5⅞—6⅜	5—5½	..
50,000	10	Feb. 26	16	14%	Bourne- mouth Gas and Water — 10 p.c.	28—30	23—25	..
388,110	10	"	7	7%	Bourne- mouth Gas and Water — B 7 p.c.	15—15½	10½—11	..
115,000	10	"	6	6/-	Bourne- mouth Gas and Water — Pref. 6 p.c.	13½—14	8—9½	..
159,740	—	"	—	4%	Bourne- mouth Gas and Water — 4 p.c. Deb.	..	67—69*	..
992,045	Stk.	Feb. 26	14	5½%	Brentford A Consolid.	261—266	79—82	..
734,920	"	"	11	4¼%	Do. B New	204—209	76—79	78½
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	81—86	..
231,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—93	68—65	..
217,380	"	Feb. 26	11	10%	Brighton & Hove Orig.	208—213	145—150	..
244,300	"	"	8	7%	Do. A Ord. Stk.	154—159	98—103	..
530,000	20	Mar. 26	12½	22/6	British	44—45	32—33	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	66—68*	..
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85—87	51—54*	..
100,000	10	"	—	—	Cape Town & Dis., Ltd.	1½—2½	3—3½	..
100,000	10	—	—	4¼%	Do. 4½ p.c. Pref.	4—6	6½—7½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—63*	59
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79—81	..
1,513,280	"	Feb. 12	5/9/4	44/-	Commercial 4 p.c. Stk.	106—108	70—72	..
560,000	"	"	5½	40/-	Do. 3½ p.c. do.	103—105	64—66	..
475,000	"	June 11	8	8%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	..
800,000	"	"	4	—	Continental Union Ltd.	76—79	39—41	..
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	61—63	..
278,400	—	—	—	11¾%	Croydon B and C 7 p.c.	..	165—175	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5½%	Derby Con. Stk.	123—125	95—100	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	10—11	..
16,313,430	Stk.	Feb. 10	4/17/4	87/4	Gas Light and Coke — 4 p.c. Ord.	98—102	67—69	68½—69
2,600,000	"	"	8½	3¾%	Gas Light and Coke — 3½ p.c. max.	76—79	56—58	57½—58
4,062,235	"	"	4	4%	Gas Light and Coke — 4 p.c. Con. Pref.	96—99	70—72	70½—71
4,674,850	"	June 11	8	8%	Gas Light and Coke — 3 p.c. Con. Deb.	72½—74½	54—56	..
130,000	"	"	10	10%	Gas Light and Coke — 10 p.c. Bonds	..	..	..
258,740	"	Mar. 12	5	3¾%	Hastings & St. L. 3½ p.c.	87—89	48—53	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16⅞	7½—8½	..
86,600	—	—	—	9%	Hornsey 7 p.c.	..	115—125	..
131,000	Stk.	Mar. 12	7½	7%	Ilford A and C.	151—154	92—97	..
65,780	"	"	6⅝	5½%	Do. B	115—118	72—77	..
65,500	"	June 26	4	4%	Do. 4 p.c. Deb	92—94	63—66*	..
4,940,000	"	May 14	9	4½%	Imperial Continental	150—160	88—91	87⅞—89½
1,235,000	"	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,242	"	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	82—87	..
2,498,905	"	Feb. 26	10	5%	Liverpool 5 p.c. Ord. A	211—213	84½—85	..
					Liverpool 5 p.c. Ord. B	146—148		
306,083	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—73	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	3⅝—3⅞	3¾
250,000	100	April 1	4½	4½%	Met. of Melbourne — 4½ p.c. Deb.	99—101	89—100	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8—8½	..
1,875,892	Stk.	July 29	4½	4½%	Newcastle&Gatsh'dCon.	96½—99½	77½—78½	..
529,705	"	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	60—62*	..
55,940	10	Feb. 26	7/14/0	7/0	North Middlesex 7 p.c.	14—15	9½—10½	..
900,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	102—104	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	2—3	..
60,000	50	Feb. 26	13	12%	Portsea, Island B	128—131	83—88	..
100,000	50	"	12	11%	Do. C	118—121	73—78	..
52,000	50	"	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	1⅞—2	..
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4⅝—5	2⅜—3	56/3—59/4½
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	76—78	..
—	—	—	—	4%	Do. " " 1911	..	..	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	86—87	57—62*	..
150,000	10	May 14	6	6/-	San Paulo — 6 p.c. Pref.	10⅛—11	7⅛—8	7⅛
125,000	50	July 1	5	5%	San Paulo — 5 p.c. Deb.	4⅞—49	40—42*	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	..	..
909,984	"	"	10	10%	Do. B	222—224	180—184	..
538,500	"	"	10	10%	Do. C	220—222		
90,000	10	May 28	9	6/-	South African.	10½—11½	9—10	..
6,609,895	Stk.	Feb. 10	5/4/0	46/8	South Met. 4 p.c. Ord.	111—113	75—77	75½—76½
—	—	—	—	—	Do. Pref.	..	94—95	..
1,895,445	"	July 10	3	3%	Do. 3 p.c. Deb.	72¼—74½	55—57	..
294,830	"	Feb. 26	8½	7½%	South Shields Con. Stk.	157—159	137—139	..
959,795	"	"	6	4¾%	S'th Suburb'n Ord. 5 p.c.	114—116	75—77	..
60,000	"	"	5	5%	Do. 5 p.c. Pref.	110—112	75—77	..
135,000	—	—	—	4½%	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	84—86*	..
647,740	"	May 14	5	5%	Southampton Ord.	99—102	75—77	76¼—76½
120,000	"	Feb. 12	7½	5½%	Tottenham — A 5 p.c.	135—138	92—97	..
782,275	"	"	6	4%	Tottenham — B 3½ p.c.	115—117	70—72	..
181,255	"	June 26	4	4%	District — 4 p.c. Deb.	87—89	61—63	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	103½—109½	89—91	..
30,000	"	Feb. 26	8½	72/6	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	112—117	..
255,636	"	"	6½	57/6	Do. B 3½ p.c.	129—134	97—99	..
108,075	"	"	5/17/8	50/3	Do. C 3½ p.c.	110—115	84—89	..
352,800	"	"	6½	51/3	Wimbledon 5 p.c.	117—122	85—90	..
98,000	"	"	6½	57/6	Epsom 5 p.c.	121—126	93—98	..
88,416	"	June 26	3	3%	3 p.c. Deb. Stk.	66—69	49—52*	..

* Ex Div.

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